GET PRIMED! ENGINE ESSENTIALS

READY TO FLY IN 15 MINUTES!
page 64

MODEL Airplane NEWS

FLY THIS WARBIRD!
Hangar 9 .60-size Mustang

BUILD IT RIGHT!
TOP 10
ARF ASSEMBLY TIPS

Learn from the master...
CUTTING-EDGE FREESTYLE TECHNIQUES

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MODEL Airplane NEWS

APRIL 2003 VOLUME 131, NUMBER 4

ON THE COVER: Bill Jensen pilots his Hangar 9 P-51 Mustang through some spectacular knife-edge flight. This classic American warbird is both great looking and a proven performer (photo by Walter Sidas).
ON THIS PAGE: MS Composit Hornet CP (photo by Pete Hall).

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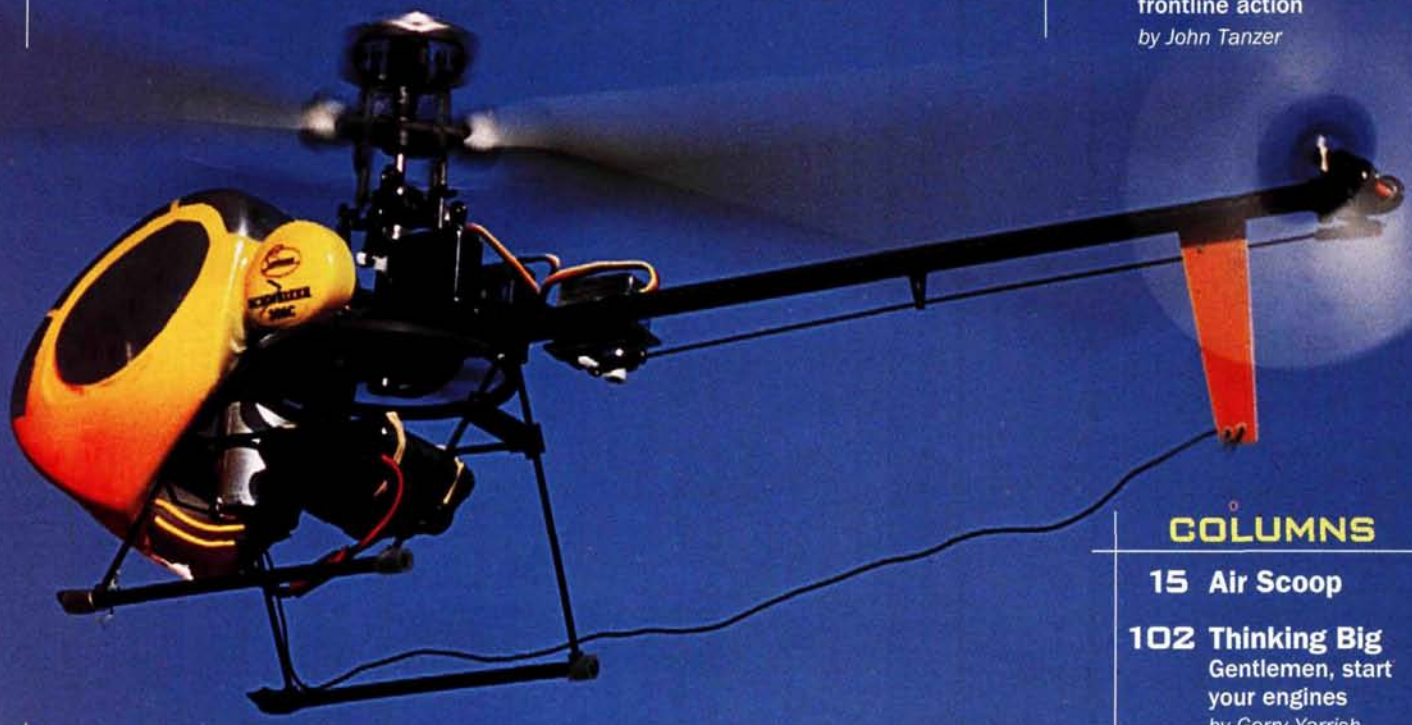

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Build it right

Almost-ready-to-fly (ARF) airplanes have three major advantages: they decrease workshop time; they're often less expensive than building from kits; and, as our reviewers often note, they're built even better than they could do themselves! You can make sure that your model is still airworthy years down the road by spending a little extra time while you assemble it, and West Coast associate editor John Reid's **"Top 10 ARF Assembly Tips"** provide an easy guide no modeler should be without.

FREESTYLE TECHNIQUES

When four-time Tournament of Champions winner Quique Somenzini asked whether our readers would be interested in a series of articles on **freestyle aerobatic techniques**, we couldn't say "yes!" fast enough. In this first installment, Quique comments on the type of airplane you need to fly extreme aerobatics and takes us, step by step, through the "Roller Coaster"—a world-class aerobatic maneuver that drives crowds wild. Check out his article on page 78 (and be sure you're a few mistakes high before you try this one yourself!).

BACK TO BASICS

In his **"Get Primed! Glow Engine Essentials"** feature article, senior technical editor Gerry Yarrish discusses basic 2- and 4-stroke operation as well as break-in, running and maintenance tips. For an inside look at fuel/oil mixtures, carburetor adjustment and glow plugs, see page 40. With engines, knowledge truly is power (pun intended!).

HIGH-VOLTAGE FUN

In only its second year, the **Northeast Electric Aircraft Technology (NEAT) Fair** has become the event for electrics enthusiasts to attend. Electric power isn't limited to lightly loaded airplanes anymore; the last event saw giant-scale and 3D flyers as well as park and backyard planes. These planes featured the latest setups and cutting-edge performance; check out associate editor Rick Bell's coverage on page 32.

DON'T MISS THIS RC EXPERIENCE!

The **RC Expo**, also known as "RCX," will be *the* radio-control show of 2003, with more simultaneous RC demonstrations than have ever taken place at one site! Hosted by Air Age Media and its RC publications, including *Model Airplane News* and *Backyard Flyer*, RCX will be held at the Anaheim Convention Center on May 3 and 4. For more details, see our preview on page 84 or check out the RCX website at www.rcexpo.com.

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FOUNDED 1929

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WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

CONGRATS TO THE CHAMPS

I was just blown away by your March 2003 article "Extreme Aerobats—18th Tournament of Champions." I have flown aerobatic models for years, and for me, the TOC in Las Vegas, NV, is the top of the food chain when it comes to highlighting piloting talent! I congratulate *Model Airplane News* for doing such a great job covering the event and, of course, first-place winner Chip Hyde! In my opinion, your article had the best coverage of all the magazines; I loved all the close-up and in-your-face photos! I hope that the TOC continues even though its creator, William G. Bennett, is no longer with us. Keep up the great work.

JOSEPH GONZALEZ
Los Angeles, CA

Joseph, thanks for your kind words regarding our Tournament of Champions coverage. We, too, were pleased with the wonderful photos our West Coast associate editor John Reid supplied with his article. John is a talented photographer, and he really brought home the bacon for us and for our readers. Let's hope that the TOC continues for many years to be the world-class competition it has always been. GY

MORE POWER?

I just completed a Midwest 1/6-scale Stearman that's powered by an O.S. .91 Surpass engine, and I've installed a Slimline smoke muffler. It now weighs 15 pounds, and I'm concerned that it might be under-powered. Using 15-percent-nitro fuel and spinning a 16x6 Zinger prop at 7,000rpm, the static thrust is about 8 pounds. I haven't had a chance fly it with this final configuration. I tried to fly it when it weighed 13 pounds, but I can't really call it a flight; the plane wallowed around tail-heavy, and it stalled and broke a prop on landing. When hung from the CG, the plane was 4 degrees tail-heavy from neutral, so I added 2 pounds to the nose. It now hangs 3 degrees nose-down from the neutral axis. I've tried a 15x6 prop, and rpm topped out at 8,200, but I couldn't see any measurable increase in the static thrust. Is there a rule for biplanes regarding the ratio between model weight and static thrust? Should I use a larger engine? [email]

FRED GROSS

Fred, first try a 16x8 prop. Your O.S. .91 should be able to handle a prop of that size, and although it won't rev as high as the smaller prop, it should produce sufficient thrust for your model. I think your original

problems were that your plane was tail-heavy, and that its thrust was insufficient. But if you find that you still don't have the necessary oomph, remove the smoke system; reducing the weight by 2 pounds will improve your performance. An engine change would require a change of cowl length and throttle linkage, but if you must have more power, use a G-23 gasoline engine. It will weigh more, but you could remove the 2-pound weight you added to the nose. Also, gasoline engines have higher exhaust temperatures, so they'll give you great smoke, if that's what you want. If it were my plane, I'd try to make it as light as possible first and add power as needed. Good luck. GY

SERVOS FOR A PITTS

Thanks for the great review of the Great Planes Pitts Special Bipe (February 2003 issue). Who doesn't love the Pitts Special? I have only one concern: in the article, you mentioned that you use Futaba 3003 servos throughout the plane. Are you really using $12 servos with 35 to 44 oz.-in. of torque on such a large plane with big control surfaces? I enjoy flying ¼-scale aerobatic planes like the CAP, Edge, Extra, etc., and I always wonder how much torque to put on these oversize control surfaces. I was really surprised to read that you're pushing/pulling two large ailerons with such a "weak" servo, or was it a typo?

JEFF COOMBES
Austin, TX

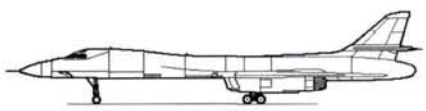
Jeff, you are correct. It was a mistake on my part. I used Futaba 9303 servos for the ailerons and 9001s for rudder and elevator. I used the 3003 for throttle only. Sorry for the confusion. GY

MUFFLER SOURCES

I have a .76 GMS ringed engine and would like to use a Pitts-style muffler on it. I understand that those are a bit noisier than the stock muffler, so I would like one that has a low-decibel level. Do you know of a company that makes one to fit my engine? Thanks. [email]

TSGT. DAVID LANGE

Hey, David; two companies that supply excellent Pitts-style mufflers are Davis Model Products in Milford, CT, (203) 877-1670 and Slimline in Scottsdale, AZ, (480) 967-5053. Davis mufflers come in a variety of sizes, and adapters to match them to your engine are available. Slimline has a very extensive line of mufflers in both standard and smoke-generating types. Give these companies a call, and you should be all set! GY ✈



NEW PRODUCTS OR PEOPLE hit the model airplane market all the time, so here's the inside source for what's hot and where you can get it. Every issue, we sift through product announcements, show reports, rumors and prototypes to let you in on the best and the latest. Remember, you saw it here first!

AIR SCOOP

by the Model Airplane News *crew*

RICH URAVITCH

CESSNA 195

Scale models of the Cessna 195 aren't something we see very often, so if you're in the market for a unique project, listen up! A plan for a 59-inch-wingspan version of this beautiful aircraft is now available from Rich Uravitch. The finished model features all-balsa and lite-ply built-up construction and should be powered by a .40 2-stroke or .48 to .52 4-stroke engine. Rich recommends Ultracote covering for the Cessna. A plastic set that includes the wheel pants, cowl and formed side windows is available separately, and a laser-cut kit version can be purchased from Hobby Hangar. Price is not yet available.

Rich Uravitch (321) 728-0486; richuravitch.com.

SEAGULL MODELS

EDGE 540 AND PC9

The folks at Horizon can now boast of yet another line of high-quality model aircraft. They are now the exclusive distributors of Seagull Models, and first out are the Edge 540 and PC9 ARFs. If you've mastered that ol' trainer and are ready to move up, check out the PC9—a sport-scale version of the famous Swiss turboprop military trainer. Constructed of high-quality balsa and ply and covered with Ultracote, the PC9 features a factory-painted fiberglass cowl, tricycle landing gear and all the necessary hardware. It has a 63.4-inch wingspan, requires a .46 to .52 2-stroke engine and sells for $134.99.

And for veteran pilots looking for a new aerobat to play with, Seagull has this 63¼-inch-wingspan Edge 540. This highly maneuverable model shares many of the same high-quality features with the PC9, including a balsa and ply construction, Ultracote covering, painted fiberglass cowl and a complete set of hardware. It requires a 4-channel radio and a .61 to .90 2-stroke or a .91 to 1.20 4-stroke engine. The Edge 540 sells for $179.99.

Seagull Models; distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

HOBBICO

Hobbistar 60 Mk III ARF

There really is only one way to learn how to fly RC aircraft: pick up a trainer and practice, practice, practice! A perfect starter plane is out there for everyone, and if you're one who thinks bigger is better, Hobbico's new Hobbistar 60 just may be

the right one for you. This all-wood model has a 71-inch wingspan for improved visibility and stability in flight. It comes almost completely assembled with a colorful, iron-on covering and a generous hardware package. You have only to supply the .60-size 2-stroke engine and 4-channel radio system. Best of all, the Hobbistar 60's semi-symmetrical airfoil allows first-time pilots to experiment with basic aerobatics without having to sacrifice the reassuring low-speed flight characteristics of a trainer. The Hobbistar .60 Mk III sells for $159.99.

Hobbico; distributed by Great Planes Model Distributors (800) 682-8948; hobbico.com.

LANIER RC STINGER ARFS

Lanier RC is well-known for its classic line of aerobatic Stinger aircraft, and flying one of these legendary aerobats is now even easier: Lanier introduces 120 and Giant Stinger ARFs. With the design that made the kit versions famous, these ARF models feature all-wood airframes with iron-on covering, fiberglass cowls and wheel pants and complete hardware packages. Specs (120/Giant): wingspan—80/84 inches; wing area—1,344/1,596 square inches; length—64/73 inches; weight—11 to 14/16 to 20 pounds; engine recommended—.91 to 2.2 2-stroke or 1.20 to 1.80 4-stroke/1.8 to 4.2 2-stroke, 4-stroke or gas.

Lanier RC (770) 532-6401; lanierr.com.

FLYING STYRO

SWIFT RACER

Not so long ago, aerobatic park flyers were virtually unheard of. But as their popularity grew, so did their availability, and today they come in a wide variety of sizes, colors and styles—including twin racers. Designed to be powered by two Speed 280 motors, the 43-inch-wingspan Flying Styro Swift Racer is a 4-channel aerobat. It features nicely painted parts, removable landing gear and lightweight foam wheels. It comes with many vacuum-formed detail parts, a nice hardware package, props and 4:1 gearboxes. Available in red and white and blue and white, the Swift Racer sells for $129.

Flying Styro; distributed by Hobby Lobby Intl. Inc. (615) 373-1444; hobby-lobby.com.

BOB'S AIRCRAFT DOCUMENTATION

20TH ANNIVERSARY CATALOG

For years, scratch-building modelers have turned to Bob Banka for the full-color photos, documentation and 3-view drawings they needed to build that perfect scale airplane. Formerly known as Scale Model Research, Bob's Aircraft Documentation boasts the world's largest commercial collection of such materials, and now you can get it all in the brand-new, 272-page 20th anniversary edition of its catalog. This new edition lists more than 8,000 photo packs and 38,000 3-view drawings and includes 11 scale-related articles. It costs just $10.

Bob's Aircraft Documentation
(714) 979-8058; bobsairdoc.com.

KLEIN AVIATIK

Alpha Profile Jet ARF

Ready for this? The Alpha Profile Jet is an aerobatic, ducted-fan, profile park flyer. How's that for covering all the bases? Designed for use with a Speed 400 or 480 motor, this snappy little aerobat features a computer-cut balsa fuselage and a built-up rib and spar wing with transparent covering. It assembles easily thanks to some special touches like precut holes for the servos and battery, and the two-piece wing is removable for transport and storage. This highly aerobatic model easily performs snap rolls, knife-edge and inverted flights. It has a 35-inch wingspan, requires a 4-channel radio and sells for $97.

Klein Aviatik; distributed by Hobby Lobby Intl. Inc. (615) 373-1444; hobby-lobby.com.

AIRFOIL HELICAM INC.

V2

Have you ever wanted to see what your RC heli sees from the air? Now, you can. Designed for use with .60-size helis, the V2 mount allows you to attach a video camera to your helicopter so you can take inflight video footage. Made from CNS-milled aluminum, the V2 can be set to pan a full 360 degrees. The vibration-free system is capable of producing broadcast-quality footage. One RC heli equipped with a V2 is already in use as a news chopper for some television stations in the Chicago area and has covered several breaking news events, including floods and fires. Though it was designed specifically with professional and commercial uses in mind, the V2 is available for private sale.

Airfoil Helicam Inc. (217) 938-4373; airfoilhelicam.com.

GIANTSCALEPLANES.COM

Staudacher S300D

Giantscaleplanes.com is a name that modelers have come to trust for producing some of the highest-quality ARFs on the market, and the new Staudacher GS-300D is certainly no exception. The 54-inch-wingspan model comes with a lite-ply fuselage, a fiberglass cowl and built-up and covered wings. The control horns and hinges come already installed, and all of the control surfaces feature beveled leading edges. The Staudacher also comes with a complete set of decals. It should be powered by a .40 to .46 2-stroke or a .52 4-stroke engine, requires a 4-channel radio and sells for $159.99.

Giantscaleplanes.com (610) 282-4811; giantscaleplanes.com.

IKON N'WEST

Cessna 170B and L-19 Bird Dog

Ikon N'west has delivered top-quality, traditional kits for more than 30 years, and these two newest releases are no exception. Take, for example, the new 1/5-scale Cessna 170B. The 86-inch-span model features a fiberglass cowl, aluminum landing gear, working doors and wing flaps. It sells for $175.50 (plus $10.50 S&H).

Ikon's already popular L-19E Bird Dog is now available in 1/5 scale. The 85-inch-span model features a fiberglass cowl and aluminum landing gear, and because the full-size aircraft featured a sheet-metal construction, Ikon includes balsa to cover the model for a true scale appearance. All parts are hand-cut from selected balsa. The Bird Dog sells for $283.50 (plus $13.50 S&H).

Ikon N'west (800) 327-7198 (orders only); (208) 773-9001; ikonnwst.com.

AVIOMODELLI

Fieseler Storch

Check out this semi-scale reproduction of a famous German high-wing aircraft from Aviomodelli. The 81.9-inch-wingspan Fieseler Storch is available in two versions: as a kit with laser-cut parts for construction of an open-frame, built-up wing and as a 50-percent prebuilt ARF with foam-core, balsa-covered wings and a vinyl covering. Both versions feature a wooden fuselage made with laser-cut parts and come with metal, spring-loaded landing gears, rubber tires, Duraflex wingtips, a gas tank, underwing servo-mounting boxes, clear plastic windows, a full set of decals and a detailed plan with instructions in English. The Fieseler Storch requires a .60 2-stroke or .90 4-stroke engine and a 5- or 6-channel radio system.

Aviomodelli; distributed by Internet-RC (602) 347-1600; internet-rc.com.

COMPACT UNIBRAKE

RETROFIT BRAKES

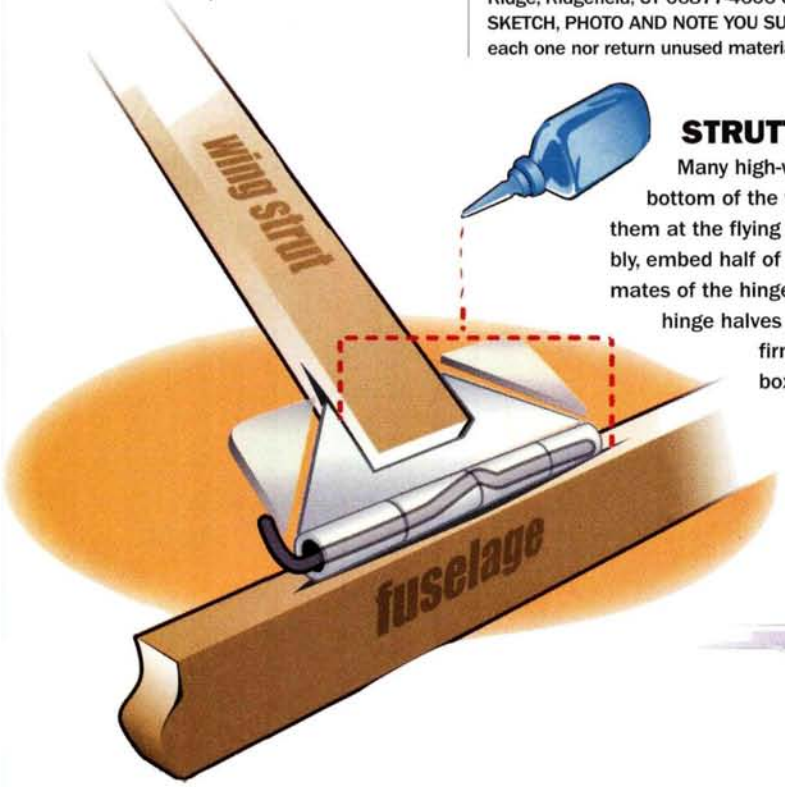
Looking for a high-quality braking system that's compatible with those old-style, two-piece Robart wheels for your ducted-fan, giant-scale and turbine-powered aircraft? Compact Unibrake now offers a precision-machined, air-power-operated O-ring braking system with aluminum silicon bronze bushings in 3/16- and 1/4-inch-axle diameters. Available in three sizes, the brakes fit wheels from 2 to 4 inches. They are easy to install and sell for $89/pair.

Compact Unibrake (818) 363-2890; compactunibrake.com.

TIPS & TRICKS

Illustrations by David Baker

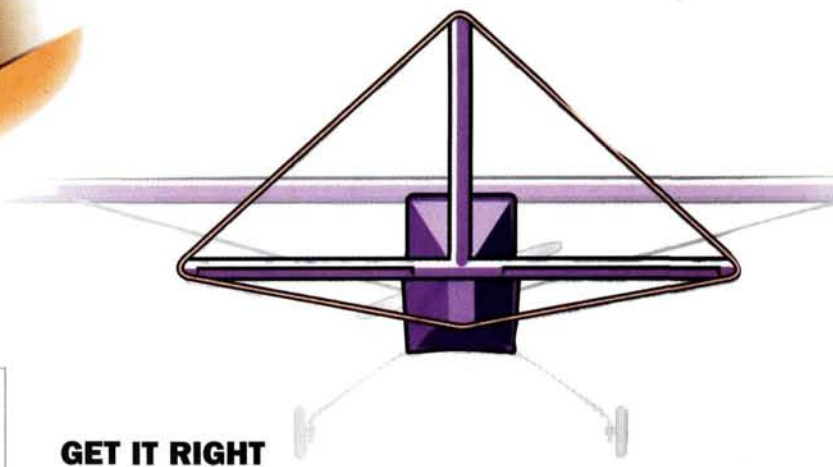
SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.



STRUTTING YOUR STUFF

Many high-wing airplanes use wing struts that you attach from the bottom of the wing to the fuselage to increase strength, but attaching them at the flying field can be time-consuming. To speed up field assembly, embed half of a pinned hinge in each end of the strut and embed the mates of the hinges in the wing and fuselage. It's now simple to join the hinge halves using a "wobble" pin. The wobble in the pin keeps it firmly anchored in the hinge. Keep extra pins in your field box in case you lose one.

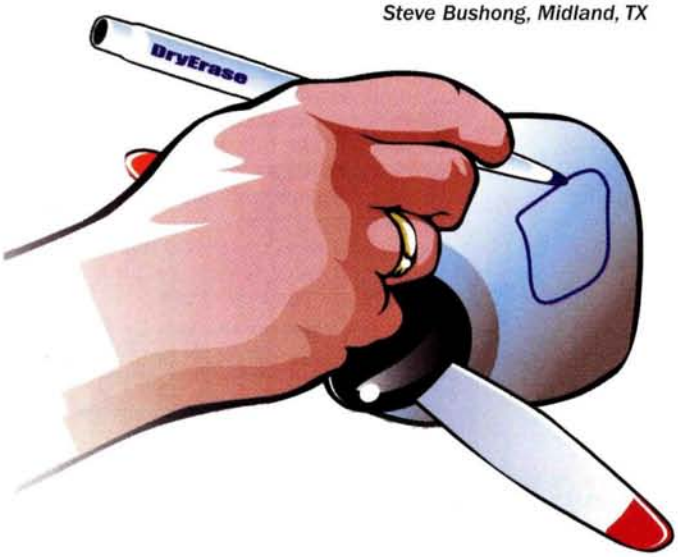
Fred Mulholland, Tampa, FL



NOW YOU SEE IT; NOW YOU DON'T

Most cowls require cutouts for the engine head, needle valve, etc. To make the cutouts accurately, you need to measure and mark them properly. Ballpoint pens and pencils don't write very well on smooth, painted surfaces, and lines made by regular markers are difficult, if not impossible, to erase. A solution is to use Dry-Erase markers—the ones used in boardrooms across the country. Like regular markers, they will leave a line on smooth surfaces, but when you've finished making the cutouts, you can simply use a rag to wipe off any remaining ink.

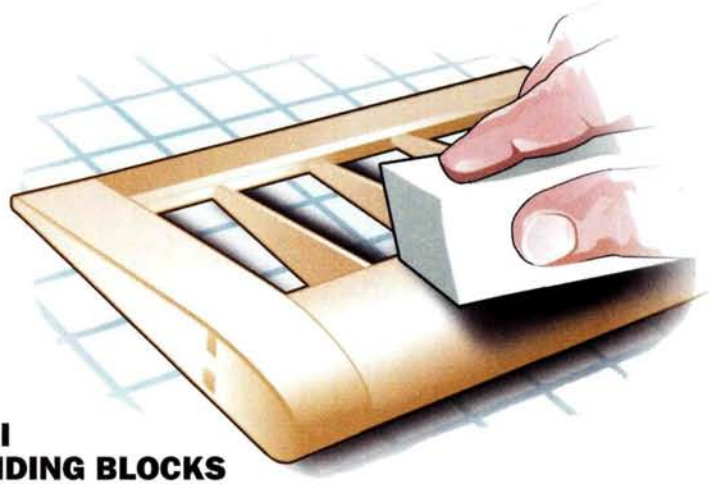
Steve Bushong, Midland, TX



GET IT RIGHT

For an airplane to fly straight, the vertical fin must be perpendicular to the horizontal stabilizer. There are many ways to hold the fin in place while the glue dries: pins, tape, etc. Here's an even easier method that works well. Take a very long, narrow rubber band and wrap it around the horizontal stabilizer, the fuselage and the vertical fin. This will hold the fin firmly in place while the glue cures, and you'll be able to make minute adjustments by slightly shifting the rubber band.

Joel Rindler, Merrick, NY

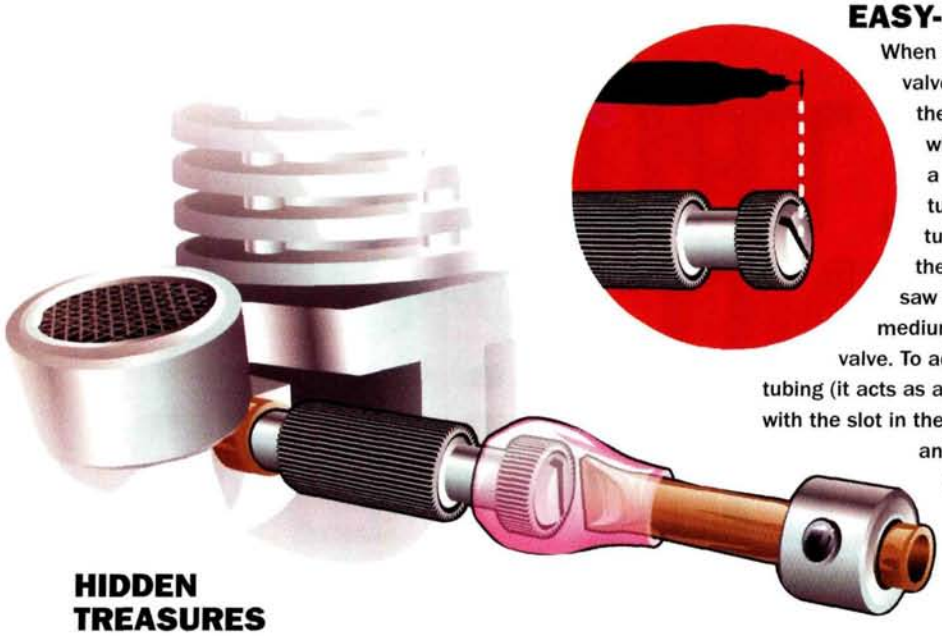


MINI SANDING BLOCKS

You never know where you will find something that makes building models a little easier. Ever notice the sanding tools used by manicurists on nails? They widely use a four-sided block with emery-board sides. These blocks work great for smaller sanding jobs where a larger sanding block wouldn't fit. They are available in a variety of grits at most beauty-supply stores.

Mike Garner, Ponte Vedra Beach, FL

EASY-REACH ADJUSTER



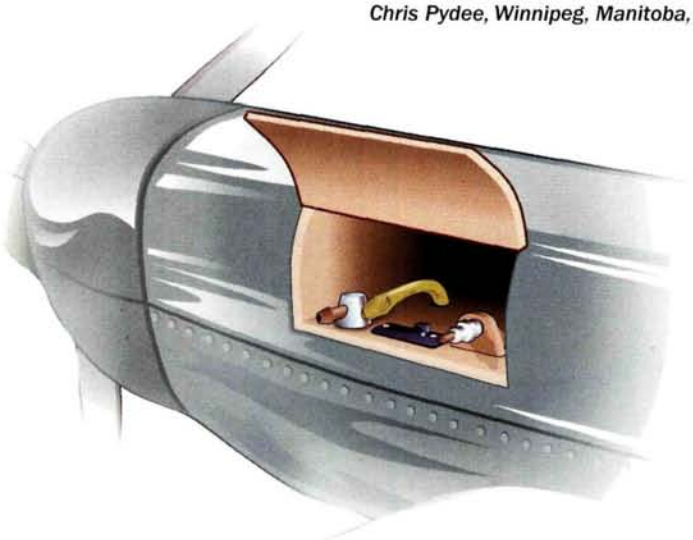
When an engine is enclosed by a cowl, adjusting the needle valve can be a challenge. You can attach an extension to the needle valve that protrudes outside the cowl, but it will tend to vibrate, and it won't be very attractive. Here's a better way: flatten one end of a length of 1/8-inch brass tube and attach a wheel collar to the other end. The tube needs to extend outside the cowl. Cut a slot across the needle valve using a Dremel cutoff wheel or a hacksaw blade, and then push a short piece (about 1/2 inch) of medium-diameter fuel tubing over the end of the needle valve. To adjust the needle valve, push the extension into the fuel tubing (it acts as a guide), and line up the flattened end of the brass tube with the slot in the needle valve. After the engine has been warmed up and adjusted, simply pull the extension out and store it in your flight box.

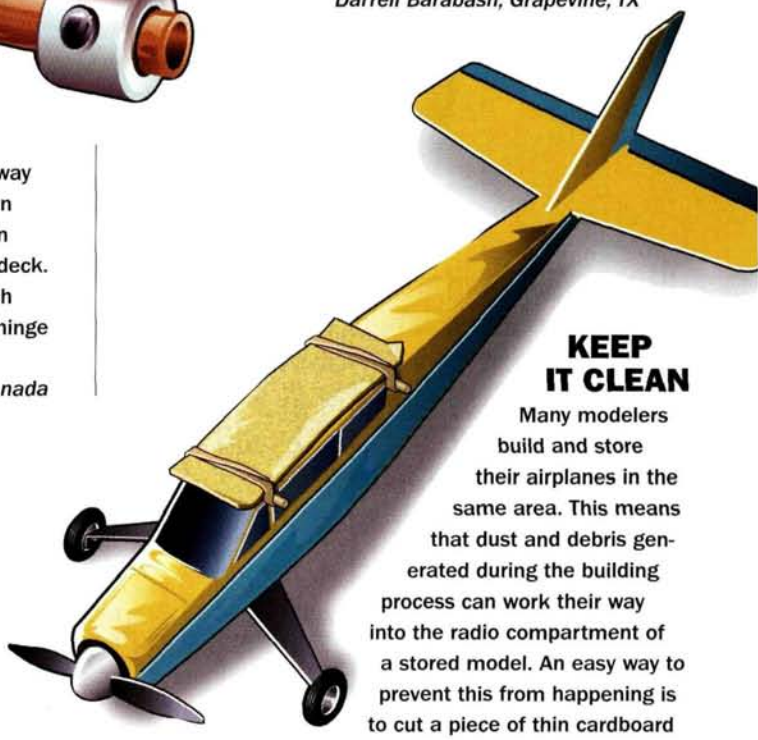
Darrell Barabash, Grapevine, TX

HIDDEN TREASURES

It can be a real hassle to access all of the air valves, switches, etc., on a plane after it has been completely assembled. Here's a simple way to provide access while also eliminating the need for multiple holes in the fuselage. When you build the fuselage, add a small deck between two of the front formers and install the valves, switches, etc., on the deck. Finish building the fuselage, and before you cover it, cut a small hatch out of the area that covers the deck. Reinforce the hatch and add a hinge and a latch to it. You now have a clean, neat, hidden installation.

Chris Pydee, Winnipeg, Manitoba, Canada





KEEP IT CLEAN

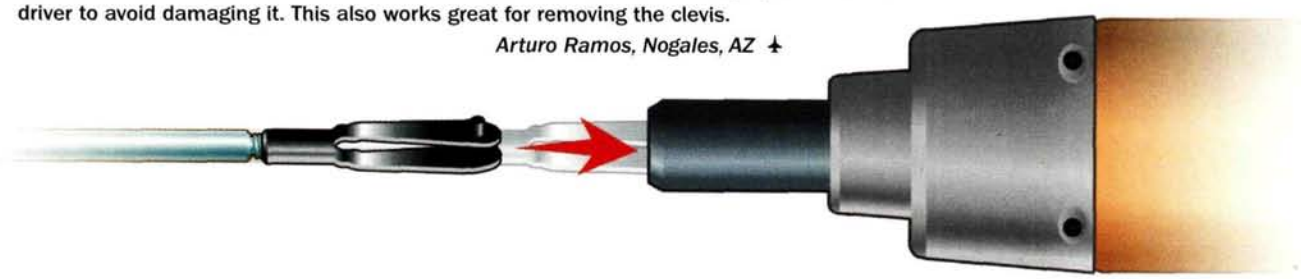
Many modelers build and store their airplanes in the same area. This means that dust and debris generated during the building process can work their way into the radio compartment of a stored model. An easy way to prevent this from happening is to cut a piece of thin cardboard to fit over the radio compartment and hold it in place with wing bolts or rubber bands. This helps to keep the model's interior dust-free.

Eric Tull, McHenry, IL

POWER DRIVER

We all know that threading plastic and nylon clevises onto wire pushrods can be a real pain in the fingers. To avoid the pain, remove the bit from the chuck in a cordless screwdriver. Insert a clevis with the threaded side out into the chuck and securely grip the pushrod. Then turn on the screwdriver and thread on the clevis. Just make sure that the clevis fits tightly in the screwdriver to avoid damaging it. This also works great for removing the clevis.

Arturo Ramos, Nogales, AZ



PILOT PROJECTS

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable but please do not send digital printouts. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Larry Dixon
Lake Havasu, AZ
P-47 THUNDERBOLT
Believe it or not, this Top Flite P-47 represents Larry's first attempt at building a warbird. Talk about beginner's luck! Larry powers his classic fighter with an O.S. 1.20 4-stroke engine and equips it with Century Jet retracts and flaps. According to Larry, his P-47 is an excellent flyer that gets its fair share of attention at the field. It's no wonder!

Tommie Weemes
Hereford, TX
1/5-SCALE HS 123A
Scratch-built from a modified Justin Cork plan, Tommie's 1/5-scale HS 123A is the definition of "a work in progress." Total construction time—10 years! Tommie used the lost-foam method to construct the model's fiberglass fuselage. Balsa-covered white Styrofoam forms the 64-inch-span lower wing, and the 82.5-inch-wingspan upper wing is of standard D-tube construction; Coverite fabric covers both. The model also features fiberglass wheel pants, cowl and bombs and custom-made, fixed main landing gear from Likes Lane. Powered by a Zenoah G-62, the 33-pound HS 123A is finished with Nelson polyurethane and custom-made graphics from CFC. Wow!

David Fernandez Garcia
Monterrey, Mexico
1/8-SCALE F6F-3 GRUMMAN HELLCAT
Built from a Wing Mfg. kit, this F6F-3 Hellcat features working flaps and scale Robart retracts. The 61-inch-wingspan model weighs 9 pounds and is powered by an O.S. 1.20 4-stroke engine. Nice job, David!

Paul Mally
Clinton Township, MI
EXTRA 300L
Completed in 2000, this Extra is Paul's very first 1.20-size model, which explains why he has yet to fly it. Built from an Ohio RC kit, this 23-percent sport-scale model has a 72-inch wingspan and weighs 12 pounds. It's powered by a Saito 1.50 4-stroke engine and controlled by a Futaba radio. Ultracote covering and Perfect Paint contribute to its spectacular appearance. It looks great, Paul; now get out there and let us know how it flies!

Richard Baylis
Westmount, Quebec, Canada
MILES HAWK MAJOR
Richard scratch-built his 1/6-scale Miles Hawk from a British plan, and he fitted it with four-piece, two-position split flaps that deflect to about 80 degrees, just like its full-scale counterpart. Powered by a Saito .65 engine, the 66-inch-wingspan model weighs 8 pounds and is covered in 21st Century fabric. It features a fiberglass cowl and a Williams Bros. pilot figure. Great work!

Charlie Kellogg
Warrington, PA
P-38 LIGHTNING

Charlie considers the P-38 to be a very important warbird, and he felt that there are too few scale models of it; so he set out to rectify the situation. Eighteen months later, he completed this reproduction of a P-38 that flew in the 55th Squadron, 20th Fighter Group and was later restored as the "California Cutie." Built from a Nick Ziroli plan modified to include servo-operated Fowler flaps, Charlie's Lightning features Robart retracts, drop tanks and air-operated doors. Powered by a pair of Brison 3.2 engines turning two 20x10, 3-blade props, the model is covered with glass cloth and finished with PPG paint. The graphics replicate those on the California Cutie. According to Charlie, his P-38 flies extremely well and is very responsive. Nice job!

Don Panek
Wofford Heights, CA
A-10 WARTHOG

Don built this Warthog from a *Model Airplane News* plan and powered it with two O.S. FX .25 engines that spin 8x6 3-blade props. It's finished with Perfect Paint and graphics from Major Decals. Don says his 7½-pound model not only flies great, but it also attracts a lot of attention at the field. It certainly got ours!

George Wardleigh
Ogden, UT
AEROSPORT SCAMP

George designed and built this 39-percent-scale model of a classic homebuilt plane using 2-views and magazine photos. He even designed its receiver himself—now, that's a scratch-built model!

George powered his original creation with an O.S. FF 3.20 Pegasus 4-cylinder, 4-stroke engine and finished it with Poly-Fiber polyurethane paint to create that striking appearance. According to George, preliminary flight tests indicate that the Scamp will be a very gentle flyer. It sure is easy on the eyes!

Alfonso Gonçalves
Rio de Janeiro, Brazil
SCRATCH-BUILT HYBRID

What do you get when you combine the best features from some of the 20th century's most famous fighters into one amazing model? We're not sure, but it would probably look something like this. Alfonso took inspiration from the Arado AR-240 for the wing, and he modeled the fuselage, nacelles and tail surfaces after the B-25 Mitchell. In addition, he developed the canopy from the T-6 Texan and designed the color scheme to match that of a specific full-size Messerschmitt BF-110. Powered by two O.S. 4-stroke engines, this 72-inch-wingspan model features Robart retracts and struts, operational flaps and gear doors and landing lights. Terrific!

Niels Hassing
Fredensborg, Denmark
PRIVATEER

The Privateer shown here is actually Niels's second incarnation of the model. He built the first in 1938, from a plan he found in *Model Airplane News*. Sixteen-year-old Niels powered his first plane with a .40ci, 2-stroke engine, but the model was grounded at the outbreak of WW II. In 1965, Niels decided it was time to get back into radio control, and Privateer no. 2 was born. Originally powered by a Merco .61 engine, Niels's second Privateer now gets around on an O.S. Surpass .48. According to Niels, it's a safe and beautiful flyer. We think it's a pretty nice story, too!

TOP 10 ARF ASSEMBLY TIPS

PREFLIGHT PREP

BY JOHN REID

Manufacturers strive to design and build ARF kits that an RC pilot can proudly show off and enjoy for many years, and more often than not, they are enormously successful. The quality, appearance and flight capabilities of the planes available today are truly outstanding, and I am among those who want to ensure that my new models will still be around for me to enjoy 10 years down the road. Fortunately, a little extra time during the final assembly will help extend the life of that new plane. Try out some of these tips on your next ARF.

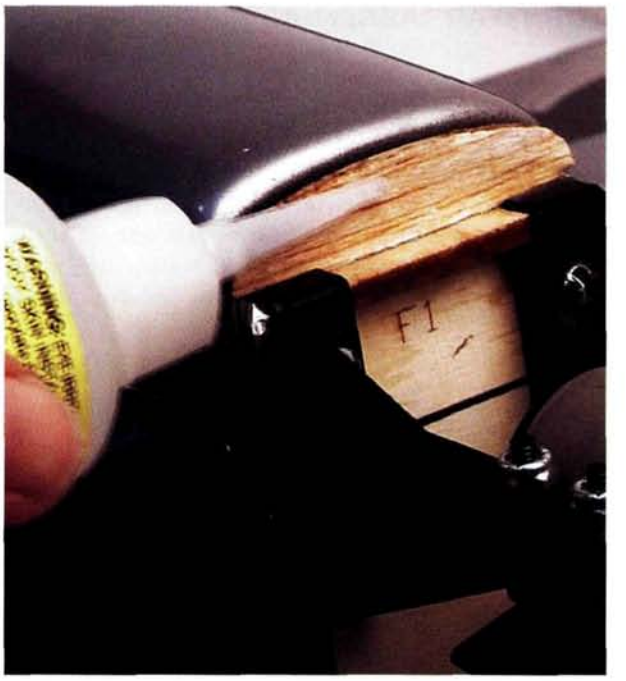
1 SEAL DOWN LOOSE COVERING

This should be the first step in the assembly of any ARF that uses heat-shrink covering. Use an iron or heat gun to remove wrinkles that may have emerged during shipping, and then turn the heat up and go over all the surfaces where the covering overlaps or ends on bare wood. Be sure you don't melt or shrink the covering too much, and pay particular attention to the engine compartment and wing-saddle areas. After you've sealed the covering where it ends on bare wood, apply CA along the edges to ensure that it stays that way.

PHOTOS BY JOHN REID

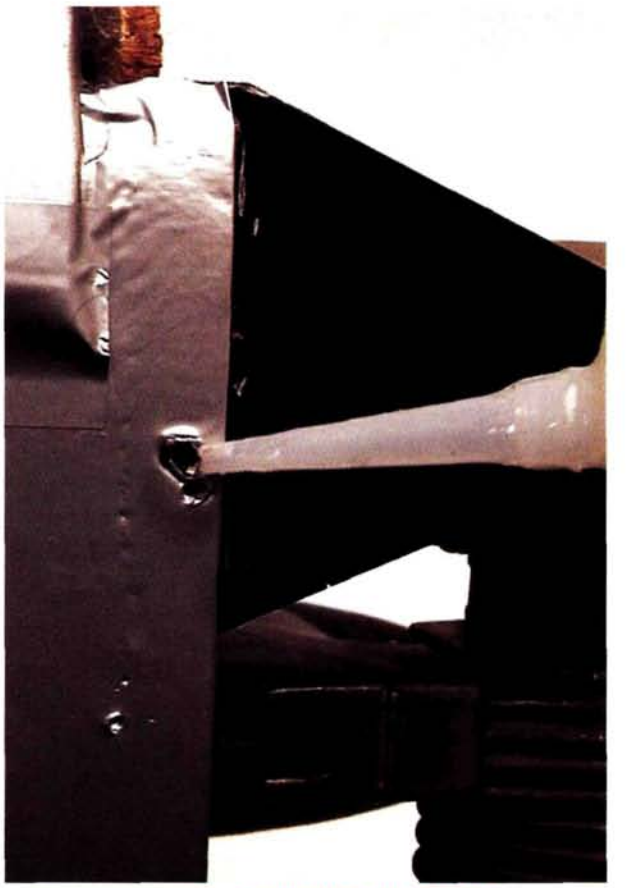
2 FUELPROOF THE FIREWALL

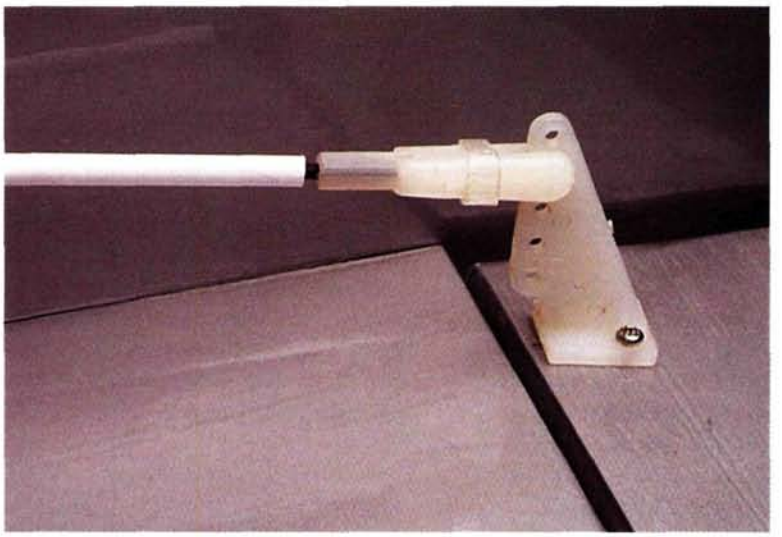
After a few flights, the firewall or engine compartment of planes powered by nitro and gas engines can incur damage if left unprotected. Check these areas, and if needed, paint, epoxy and CA can provide the necessary protection. (Heat-shrink covering material will not sufficiently protect these areas from repeated exposures to fuel and gas residue.) The paint can be sprayed or brushed on, and the epoxy should be thinned with a little rubbing alcohol and applied with a brush. Thin CA can be dripped on the surface and allowed to soak in, but thick CA should be rubbed in with your finger; of course, it's a good idea to wrap your finger in plastic.



3 CHECK HIGH-STRESS GLUE JOINTS

All visible glue joints should be checked for cracks or stress breaks when you unpack a new kit. Damage can easily occur during shipping; changes in humidity levels from one part of the country to another can warp parts and cause cracks or other damage to joints. When checking the joints, pay particular attention to high-stress areas such as the wings, stabilizer, rudder, firewall, landing-gear attachments and servo trays. Repair the damage with CA or epoxy, and reinforce that area with balsa triangle stock, plywood, or fiberglass cloth.





4 RUBBER TUBING AROUND THE CLEVIS

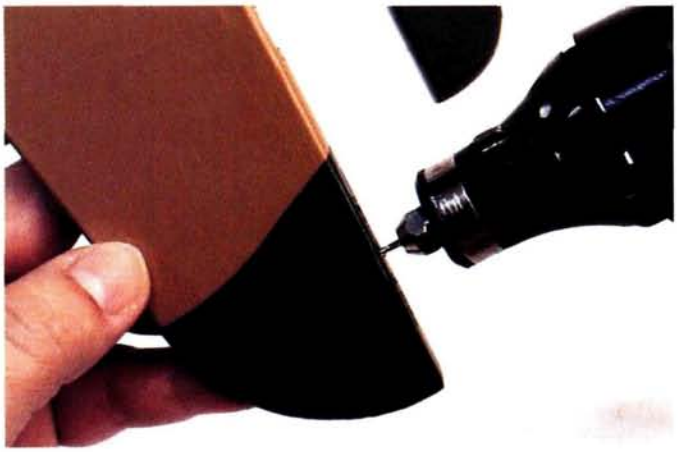
When the control surfaces deflect, pressure builds on the control horn and the clevis. The weakest link is the clevis—specifically, on its tiny pin. The pressure can generate enough force to pop that clevis pin loose, but rubber tubing will help prevent this.

5 REINFORCE THE SCREW HOLES WITH CA

All screw holes in wood (balsa, plywood and hardwood) should be reinforced with CA, especially those for the control horns, servos, canopy and cowl. Drill the hole, insert the screw and remove it, and then drop thin CA into the hole. This will strengthen the wood and prevent it from being stripped.

6 SEAL FUEL-TANK TUBING AT THE FIREWALL

Tubing that exits through holes in the firewall will eventually wear out from vibration, but you can prevent this by sealing the fuel tubing at the firewall with silicone sealant. Tanks that extend through the firewall should also have sealant around the hole; this will stop any fuel from seeping into the tank compartment.

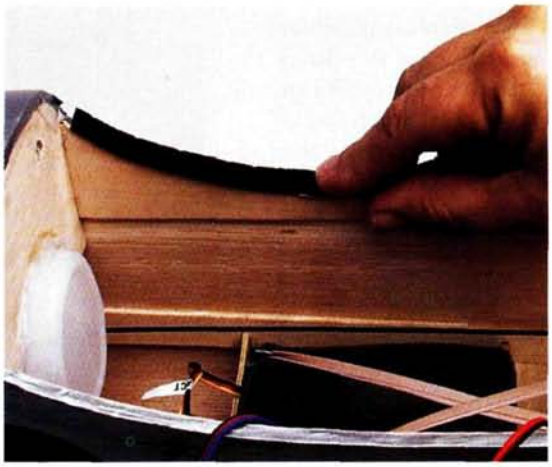


7 PROPERLY INSTALLING THE HINGES

The CA hinges that are included in many ARF kits do a fine job of supporting the control surfaces. They are usually chemically treated to encourage the CA to wick to all parts of the hinge and provide good adhesion, but this process can be helped along by drilling a small hole (3/32 inch) in the center of each hinge slot. This gap above and below the hinge will allow the CA to penetrate all the way to the back of the hinge.

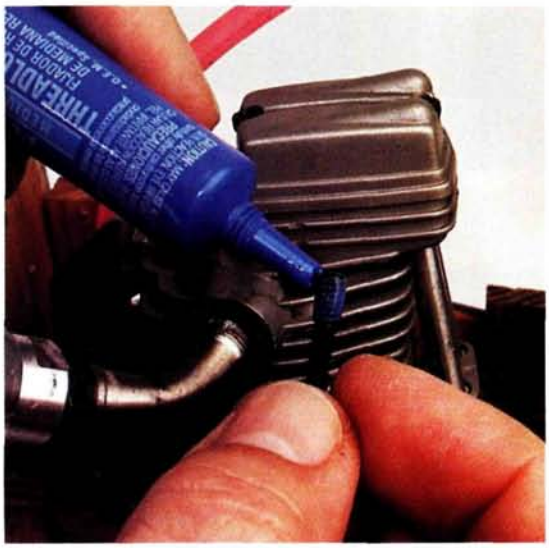
8 FOAM TAPE ON THE WING SADDLE

Exhaust residue that enters through the wing saddle can damage unprotected wood in the plane's interior and will eventually ruin it. You can protect this area by applying foam tape around the wing saddle. It will form a fuel-proof seal and is soft, so it won't hinder wing alignment.



9 THREAD-LOCK ALL BOLTS

With the exception of engine screws, all of the bolts that screw into nuts, blind nuts and threaded metal pieces benefit from thread-lock. It reinforces the grip and provides a measure of insurance that the screws won't vibrate loose. This simple step can save you quite a bit of grief later.



10 KEEP THOSE WHEELS ROLLING

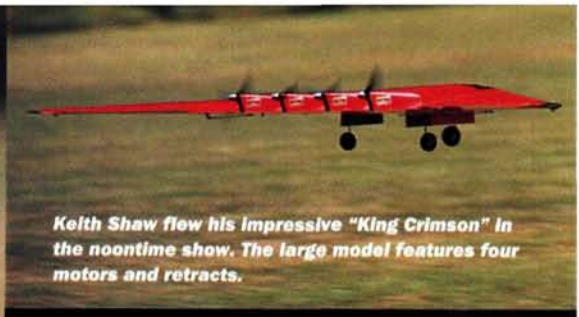
To ensure that the wheels remain in place, use a small file or a rotary tool to grind a small flat spot on the axle beneath the wheel-collar setscrew. This flat spot will prevent the wheel collar from sliding off. Don't forget to apply thread-lock to the setscrew.

So, the next time you're getting ready to build a new ARF, remember these tips. By following just a few, you can extend the life of your favorite ARF. If you follow them all, you'll enjoy that plane for many years to come. Good luck!

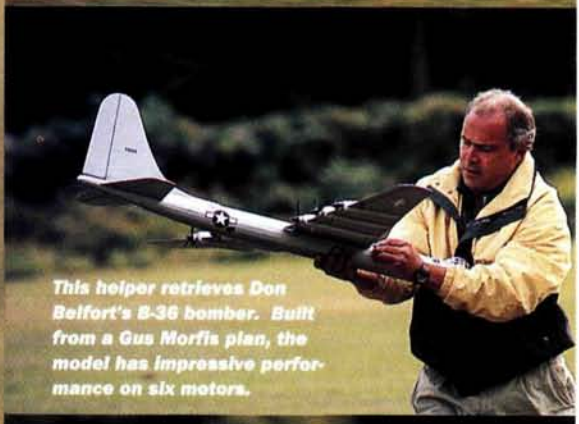
HIGH-VOLTAGE ACTION

THE LARGEST NEAT FAIR FLY-IN EVER! *by Rick Bell*

Take more than 1,000 electric-powered models, two days of glorious weather with light winds and an incredible flying site, and what do you have? The 2002 Northeast Electric Aircraft Technology (NEAT) Fair—the largest ever gathering of electric-powered models. Held on September 13, 14 and 15, 2002, for the third year at the Peaceful Valley Campsite in Downsville, NY, the NEAT Fair was a resounding success. It hosted almost 300 registered pilots—with some of the most technologically advanced electric models—from 37 states, two Canadian provinces and another foreign country, and 31 vendors and nearly 1,200 spectators.



Keith Shaw flew his impressive "King Crimson" in the noontime show. The large model features four motors and retracts.



This helper retrieves Don Belfort's B-36 bomber. Built from a Gus Morfis plan, the model has impressive performance on six motors.

Our neighbor from the north, Laddie Mikulasco, showed up with his Canadian Bug and attracted quite a crowd.

Ron Daniels' Mk. V Tempest really caught my eye. This warbird was built from a Trillian kit; it spans 41 inches and uses an AstroFlight 035G motor.

Above: Dave Baron brings in his large-scale B-17 after a successful bomb run. Dave certainly knows how to fly the B-17; you'd swear a full-scale B-17 was flying overhead (only the radial-engine noise was missing).

VERY NEAT SCALE

One area that adapts extremely well to e-power is scale. Many finely detailed models can be crafted and flown using e-power. The absence of gooey exhaust residue and the low vibration levels are but two of the advantages of e-power. Scale was well represented at NEAT. Giant-scale warbirds, biplanes and even peanut-scale models were all displayed and flown, and all were spectacular in their element. With so many beautiful models, I didn't know where to start, so I'll let the pictures do the talking!

Right: scale modeler Don Belfort brought his E-Nats-winning Spirit of St. Louis. A Speed 400 motor geared 1.8:1 that uses an 8-cell, 500mAh battery powers this gorgeous scratch-built model. Here's a closeup of Don's "Spirit." He hand-burnished aluminum tape to achieve the swirl marks on the model's nose.

VENDORS' ROW

One of the nice things about a common-interest event such as the NEAT Fair is that it isn't just an electric fly-in, but it's also a great place to gather information and to browse and purchase the latest gadgets and gizmos for e-powered models. Vendors who cater to electric-minded modelers pack the back row with tons of stuff.

This year, 31 vendors presented an impressive array of goods; in fact, you could have bought a model, outfitted it with any number of motor, battery and ESC combinations and a radio system, assembled everything and then flown it at the meet! The most difficult decision is choosing what to buy!

I always like to stroll through the vendors' area; you never know which new and innovative products you'll find. FMA Direct's booth displayed the range of lithium-polymer (li-poly) cells that will soon be released (see "Invasion of the micros" sidebar). Several modelers have been using them with very promising results. Inner Demon showed the latest gearboxes. These slick units come in single and twin sizes to accommodate .25- to .40-size glow models and a larger gearbox for .60-size models, and in gear ratios that range from 3.3:1 to 8.3:1. They're CNC-machined of aluminum and are hard-anodized for durability. The inner pinion design allows easy changes for experimenting with different gear ratios. Hobby Lobby's presence was huge; many of its new models were displayed, and it looked as if the HL folks had brought their entire warehouse to sell. Between selling and flying, Larry Eddy and Mike Hines never got a break during the weekend; their booth was always busy!

There were really too many things to tell you about; why not experience NEAT yourself next year? I know I'll be back!

Hobby Lobby's Larry Eddy displays their new profile Mustang. This 39-inch-span ARF is powered by a Speed 400 motor, its flying weight is 21 ounces, and it delivers rock-solid performance.

Inner Demon displayed its unique gearboxes on the ground and in the air in a variety of models. They are well-suited to converting larger glow-powered models to e-power.

If you've always believed that electric models are limited to floater types with marginal performance, then attending the NEAT Fair will definitely change the way you view these models. All types of model were represented: giant-scale warbirds, gliders, ducted-fan jets, pattern and 3D-capable models, pylon racers, F5B high-performance sailplanes, helicopters, scale, sport, park flyers and ornithopters down to the smallest 3-channel models. The huge turnout is a testament to the growing popularity and advances that are being made in this facet of the RC industry; it's definitely a sign of better things to come for the electric modeler.

IT'S SHOWTIME!

It takes more than a great venue to make a great event; you need lots of help and organization to keep things running smoothly. Premier electric modelers Tom Hunt and Bob Aberle were the contest directors and the driving forces. They enlisted help from members of the Silent Electric Flyers of Long Island (SEFLI), the Grumman Wingnutz and the Connecticut Silent Flyers to help run the impound and flightlines and perform other duties.

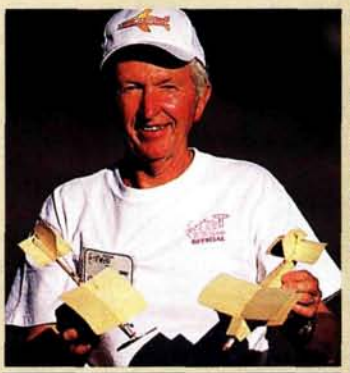
The Fair officially started on Friday, although many pilots arrived on Thursday and quickly filled the nearly 100 available pit areas that stretched about 1,500 feet. This was a big weekend! The flightline had 10 pilot stations, and the park/slow flyers were stationed on the last three spots on the right end of the flightline. This proved to be a good idea, as it eliminated possible conflicts and midairs with faster moving models; it wasn't unusual for several models to fly at the same time. To fly during the event, the pilot first had to retrieve a frequency pin and his transmitter from

INVASION OF THE MICROS

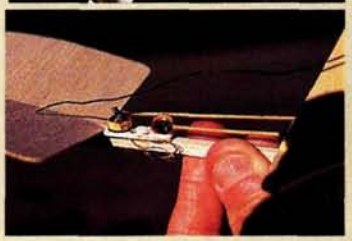
The NEAT Fair had many fascinating aspects, but among the highlights were the seminars and flight demonstrations of the micro models. These lightweight wonders weigh mere grams, have 3 channels and are very capable flyers. It's amazing that a 5-gram (that's 0.16 ounce, folks!), 3-channel model can be produced from readily available commercial products. What really makes these models possible are the lithium-polymer (li-poly) batteries they use. These powerhouses are close in size to a large postage stamp, about ⅛ inch thick and remarkably light. A Ni-Cd cell has a 1.2 nominal voltage, a NiMH about 1.1 and a li-poly, 3.7. This makes a single li-poly cell roughly equivalent to a 3-cell Ni-Cd or NiMH pack.

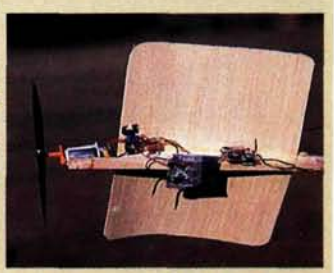
Notable micro modelers such as Henry Pasquet, Joe Malinchak and Sergio Zigras, gave several very informative seminars that covered control systems, motors, batteries and much more. At one of them, it was obvious as I looked around at the audience that people were as fascinated as I was to learn about the intricate details of building and flying micro models.

A highlight for me was when Henry, flying one of his Bantam models, handed me the transmitter and let me fly it. I was totally caught off-guard but nevertheless accepted the challenge, even though I had never flown such a tiny model and didn't know what to expect. The flight was truly inspiring; control of the model was better than that of some of the larger backyard models I had flown in the past, and the more I flew it, the bigger my smile! Keeping the plane at a complete standstill in a gentle breeze just a few feet from me was quite a flying thrill! I can now understand why modelers are so fascinated by micro models.



Bob Aberle holds two of Henry Pasquet's micro models that feature full 3-channel control, span around 5 inches and weigh a few grams. They use Knight & Pridham KP-00 drive and prop with a Ruijsink receiver and Mueller actuators. Henry uses a li-poly cell for power.





Left: a close-up of the Mueller actuators. They provide more than enough muscle for the rudder and elevator. Above: the li-poly cell delivers 3.7 volts or as much as a 3-cell Ni-Cd or NiMH pack.

the impound. At the flight line, the pilot was assigned a flight station and a spotter, if necessary. This system worked quite well throughout the weekend, as nearly 800 flights were logged!

I didn't expect to see so many notables at this gathering. Among the famous were Dick Miller, Tom Hunt, Bob Aberle, Bob Kopski, Nick Ziroli, Keith Shaw and Henry Pasquet. This was the place to learn everything about e-powered models!

NEAT ACTIVITIES

There were many things to see and do besides watching the many models that flew constantly. Friday and Saturday featured noontime demonstrations, night flying, seminars, award presentations and more. During the demo flights, the many models flown highlighted the diversity and capabilities of electric models. The Friday night sold-out dinner was again popular with the 160 hungry pilots and modelers who attended. During dinner, John Worth inducted Tom Hunt into the Vintage R/C Society's Hall of Fame, much to the surprise of Tom. Afterward, some of the modelers returned to the field to fly more. What a great way to end the day! It was a big surprise when, at the field, Keith Shaw was inducted into the AMA Hall of Fame.

If you went to NEAT to gather information on micro models, you weren't disappointed; well-attended seminars on Friday and Saturday were given by Henry Pasquet, Joe Malinchak and Sergio Zigras, and many modelers waited outside the tent trying to peek at the models. A lot of questions were asked and answered.

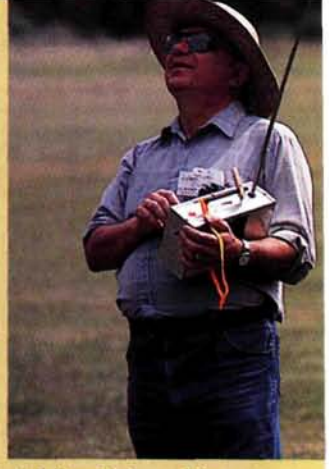
Many modelers continued flying well into the night, and for those intrepid pilots who were willing, there was a night-flying contest in which sev-

Henry Pasquet points out some of the finer details of a micro model. The seminars proved to be very popular.

Peanut-scale models such as this old Sterling Citabria make great conversion projects. Here, Joe Malinchak's model is being readied for another flight. The 3-channel model uses a KP-00 motor, lithium cell, Ruijsink receiver and FMA MicroMag actuators.

NOONTIME ANTICS

To showcase the different types of e-powered models and their capabilities, on Friday and Saturday, some notable pilots put on an hour-long noontime display. Nick Ziroli, Keith Shaw, John Marien, Gary Wright, Dave Grife, Dave Baron, Peter Marlin, Steve Newell, Bob Kopski and others absolutely captured the spectators' attention with flights that had to been seen! Everything from scale, the early days of RC and jets to smooth and slippery sailplanes that literally blasted off to out-of-sight altitude in mere seconds was flown.



Bob Kopski showed the crowd what it was like to fly RC in the early days. He flew a "Wild Hare" complete with a galloping-ghost radio system. Note the single-stick transmitter.

Keith Shaw and his large-scale "King Crimson" flying wing led off Saturday's show, followed by Dave Grife and his magnificent Golden Age Travel Aire Mystery Ship. Both planes are veterans of many flights and looked spectacular against the bright blue sky. Gary Wright flew his own-design E-3D and showed us what an e-powered 3D model can do. This model accommodates many power systems and performs any 3D maneuver you can think of. By the way, to launch the model, he holds it vertical and just lets it go. Who needs a runway! For graceful aerobatics, Gary also flew the new Lexx that's available through Hobby Lobby. This FAI-style pattern aircraft has very impressive performance. If not for the lack of sound, you'd swear you were watching a .60-size, glow-powered model.

The jet set was well represented by Dieter Mahlein flying a high-performance Vector Pro and Nick Ziroli with his Kyosho Learjet. The Vector Pro, powered by a Schubler 90mm (3.54-inch) fan mated to a Plettenberg 220 20 Series motor and a 22-cell 2400mAh Ni-Cd pack was impressive indeed. This combination produces almost 40,000rpm on the fan, and the model hit speeds of more than 100mph—something I didn't think was possible with an electric ducted fan. It truly amazing to watch this model streak across the sky and wow the crowd!

Gary Wright releases his E-3D for a flight. He hand-launches the model vertically and then performs a spectacular 3D routine.

The most exciting flights, though, were those by the F5B sailplanes; these models leave a very lasting impression! Imagine a funny car going down a drag strip at more than 200mph. Now, take a streamlined, sleek sailplane: right after you launch it and hit the throttle, it accelerates at the same speed, only straight up to several hundred feet in just a couple of seconds! That's what Steve Neu (current F5B world champion) and Peter Marlin showed us, and the gasps from the crowd said it all! This extreme performance comes at a price, though, as the motor draws an average of 125 amps (that's more than most arc welders!), so they can be run for only about 3 seconds at a time without melting the batteries. But what a 3-second ride!

These were just a few of the noontime performances in an electrifying show!

Above: the F5B demo was just incredible! These sailplanes literally rocket straight up and out of sight in a couple of seconds, and they can hit speeds of 135mph. Left: this Hobby Lobby ARF pattern ship, the Lexx, spans 61 inches and weighs about 6 pounds. A direct-drive Jeti Phasor 45/3 motor and a 16-cell, 2400mAh battery provide the power, and its performance is nothing short of graceful.

AWARDS AND SPECIAL RECOGNITIONS

Several awards and three very special honors were handed out. On Friday night, Tom Hunt was inducted into the Vintage R/C Society's Hall of Fame, and on Saturday, at the field before the noontime demonstrations, Keith Shaw was inducted into the AMA (Academy of Model Aeronautics) Hall of Fame.

These honors were bestowed on Tom and Keith for their many contributions to the advancement of the RC industry, most notably in the electric arena. Tom is senior aero test engineering specialist at Northrop Grumman, and many of his original designs have been published in modeling magazines. Tom's model manufacturing and design company, Modelair-Tech, caters to electric-powered flight. Keith has been an advocate of e-powered models for many years and has designed and flown quite a few unique electric models.

A new award—the John Sermos Memorial Fund—was unveiled and presented to the most impressive junior modeler flying at the NEAT Fair: 9-year-old Richard Baron of Roxbury, CT. Richard has been flying for about four years and is a very accomplished pilot.

The John Sermos Memorial Fund award went to 9-year-old Richard Baron (left). This accomplished pilot has been flying RC since he was 5.

Three other trophies were awarded. Best of Show went to Allan Mrock of Oxford, MI, for his magnificent, twin-motor Sikorsky S-38 flying boat. Can you say museum scale? The Largest Model award went to Dave Baron of Roxbury, CT, for a sweet-flying B-17. I've seen full-scale B-17s fly, and Dave does a great job of emulating one. Mike Hines of Hobby Lobby distinguished himself by getting the Most Flights (27 official flights). Every time I turned around, Mike was on the flightline with a different model, and I'm sure he had other flights that I didn't see. In addition, there were many pilot raffles and raffles for the general public with a lot of great prizes. Congratulations to all the winners!

Alan Mrock's magnificent 1/12-scale Sikorsky S-38 flying boat won Best of Show.

eral tasks had to be flown without any ground-based lights. Several pilots took the challenge and had a great time.

FINAL THOUGHTS

The ideal ending to NEAT would have been a third sunny day, but that was not to be. Sunday started with showers that turned into a steady downpour by noon. Everybody decided to call it a day.

The future of electric flight is very bright, indeed. New breakthroughs in batteries and radio systems seem to happen daily. Who knows where it will lead? The NEAT Fair has become the largest event for e-powered models and promises to grow even bigger. If you're interested in electric flight, make plans to attend next time. NEAT won't disappoint! ✈

NIGHT FLYING

The action didn't stop when the sun went down; night flying was very popular and continued until well after midnight. The night sky looked as if many UFOs were descending on our location! The Fayette Night Flyers of Atlanta, GA, really lit up the heavens. Their well-engineered night-flying models' flights were choreographed to music—a first! It was very cool!

This Zagi flying wing had tiny lights embedded in the wing to spell out "NEAT FAIR." The inflight effect was unique.

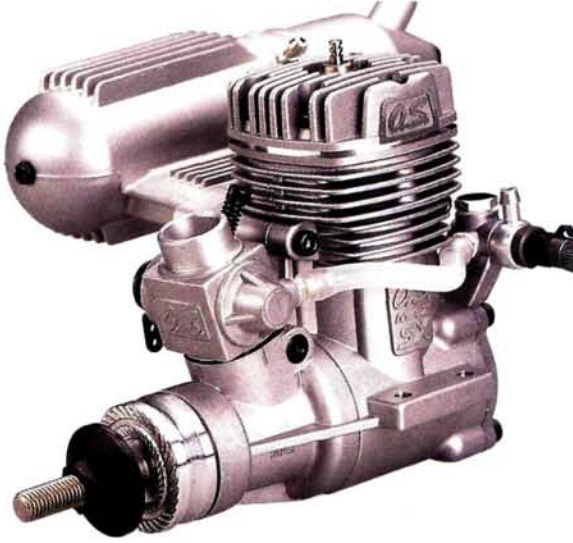
Left: night flying was very big. Many modelers lit up their models and had a ball. This Elipstik's typical setup included a transparent covering and lights installed under it.

A Graupner Tipsy is being prepped for the night-flying contest. Several cyalume sticks adorn the model.

To light the models, they inlayed countless tiny, very bright lights in several contrasting colors on the tops and bottoms of the wings. A few of the models had transparent covering, and the lights were strung throughout the structure: the effect while they were flying was stunning. A classic "old-timer" model that absolutely shimmered dropped about a dozen glimmering lights that floated slowly to the ground.

For those willing to test their skills and their luck, NEAT had a Slow Flyer contest on Saturday night in which 11 modelers navigated their models around a timed course. Each pilot was given 3 minutes to complete four challenging but not impossible tasks. The pattern was laid out in cyalume sticks, and ground-based lights weren't permitted. I watched from the sidelines, and it looked as if the pilots were having a grand time; I know that the throng of spectators who stayed to watch certainly did!

GET PRIMED!



Glow engine essentials

by Gerry Yarrish

Radio control model airplane engines are marvelous pieces of engineering. Two-stroke and 4-stroke glow engines are by far the most popular ways to power model airplanes, but if you are making the transition from electric to glow power, you should learn a few basics. Each type of engine has its benefits and drawbacks, and the choice of which to use is up to you. Let's take a closer look at these impressive power systems.

TWO-STROKE ENGINES

Two-stroke engines are the most used engine types, and they have a good power-to-weight ratio (you get a lot of power for each ounce of engine weight). They have few moving parts and are relatively inexpensive. Maintenance is very easy, and with proper break-in, a 2-stroke engine will last many years.

These engines range from .010 cubic inch (ci) to over 3ci, but .40 to .60ci are the most used sizes. Also very popular are engines with displacements of: .049 (½A), .10, .15, .25, .32, .45, .46, .50 and .90ci. All model airplanes have a recommended engine-size range, but most perform best when powered by an engine that's toward the top of that range. Nothing is worse than having an under-powered model, especially when you are learning how to fly.

ENGINE TERMINOLOGY

You should know a few basic engine terms (see Figure 1).

- **ABC**—refers to the materials used to make the engine: aluminum piston (A), fitted inside a brass sleeve (B) that's chrome-plated (C) [non-ringed engine].
- Crank**Case**—the main body of the engine.
- **Conrod**—the connecting rod; the part that attaches the piston to the crankshaft. It has a bushing at either end and is connected to the piston with a wristpin and to the crankcase with the crankpin.
- **Head**—the part on top of the engine; it's usually bolted on with four or six bolts. In its center is a threaded hole for the glow plug.
- **Ports**—channels (openings) inside the engine case that transfer the fuel/air mixture from the crankcase to the combustion chamber. The ports are opened and closed by the piston's upward and downward motions.
- **Sleeve**—the cylinder lining; it houses and guides the piston and is separate from the engine case; it has openings (ports) cut in its side.

ENGINE BREAKDOWN

The engine case usually has three parts:

- **Front housing**—the case that surrounds the crankshaft.
- **Crankcase**—the main case on which the cylinder head sits.
- **Backplate**—the part that seals

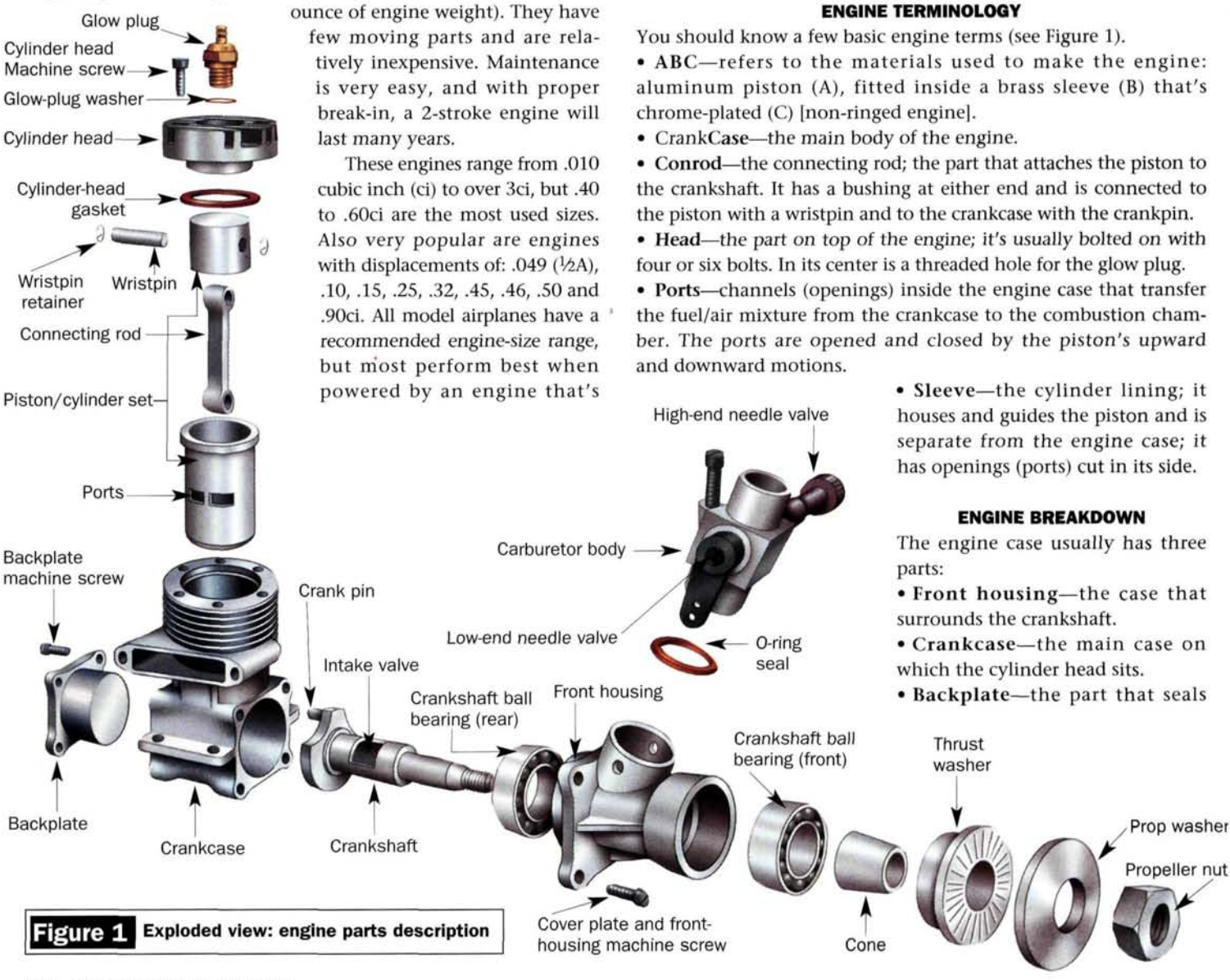
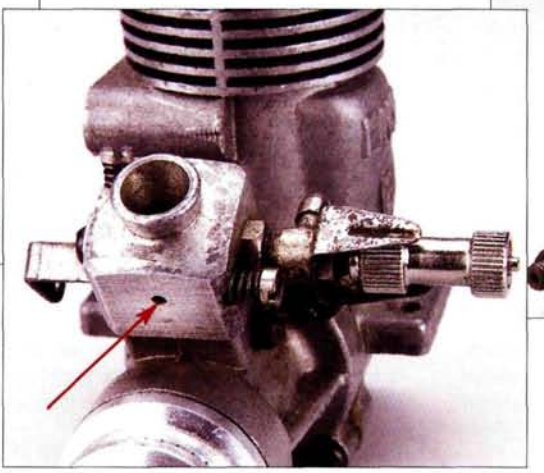


Figure 1 **Exploded view: engine parts description**

This Enya .50SS has a 2-needle carburetor. The large needle adjusts the high-end fuel mixture, and the small screw (see arrow) adjusts the idle mixture.

Below: this older Enya .29 has an air-bleed hole (arrowed) at the front of the carb body and an adjustment screw to control the idle mixture.



Four-stroke engines such as this Saito FA-56 are very popular. Instead of intake and exhaust ports, cam-driven valves and rocker arms control the fuel flow into and out of the combustion chamber.

the back of the engine.

Some engines have a two-piece case, but the "internals" of all 2-stroke engines are the same. The crankshaft is supported within the front housing by ball bearings or bushings, and it has a threaded front end. Bushings, like bearings, are machined parts in which other parts turn, and they are often used in less expensive engines. A prop nut and a prop washer secure the prop against the thrust washer at the front of the engine. At its rear, the crankshaft has a counterweight web and a crankpin that engages the bottom end of the conrod.

The connecting rod is attached to the piston with a wristpin. The piston fits inside the engine's sleeve, which fits into and is supported by the engine case. The head sits atop the cylinder and the inner sleeve, and the space between the top of the piston and the bottom of the head is called the combustion chamber.

BASIC 2-STROKE OPERATION

A 2-stroke engine makes one revolution for every power cycle (see Figure 2). As the piston moves upward in the cylinder, it compresses a fresh fuel charge. The fuel/air mixture heats up and is ignited by the glow plug. The piston's upward motion creates negative pressure inside the crankcase below the piston, and this draws air and fuel in from the carb when the intake valve opens. The combustion of the fuel/air mixture forces the piston downward, and that compresses the fresh fuel charge. As the piston travels down and the hollow crankshaft rotates, the intake valve closes and the intake ports are opened. The compressed-fuel charge passes upward through the ports and into the combustion chamber. This happens just as the last of the spent fuel charge exits the combustion chamber through the exhaust port. As the piston moves upward again, it closes the exhaust port and opens the intake valve, and the entire process is repeated.

FOUR-STROKE ENGINES

Many modelers enjoy using 4-stroke engines because they have a wide powerband (they provide more torque at lower rpm) and sound so nice while they're running. They are, however, somewhat more expensive and more complicated than 2-strokes and require a bit more maintenance to operate properly.

Instead of intake and exhaust ports, a 4-stroke engine has intake and exhaust valves (see Figure 3). The crankshaft drives a cam assembly and lifter rods, and tappets and valve springs open and close the valves at the right times. Four-strokes produce a fair amount of power, but they're at their peak at a lower rpm range than 2-stroke engines of the same size. In comparison, the power of a typical .90 4-stroke is roughly equivalent to that of a .60 2-stroke engine.

GLOW PLUGS

A glow-powered (nitro) engine uses a glow plug to ignite the fuel. In the center is a coil of platinum wire that glows bright red when it is attached to a 1.5 to 2V glow driver. To start the engine, the glow plug is energized with the glow driver; after the engine has started, the driver is removed because the piston's compression of the fuel charge in the combustion chamber fires the glow plug to ignite the fuel mixture. If an engine fails to start or begins to lose power, check

Left: model airplane engines use glow plugs to ignite the fuel charge. Several kinds of plugs are available, so check your engine's instruction manual, and use the one recommended by the manufacturer.
Right: when you first get the engine, avoid the temptation to turn the crankshaft by hand. Carefully open the backplate, and look inside the crankcase first to make sure that there isn't any debris inside that could damage the engine.

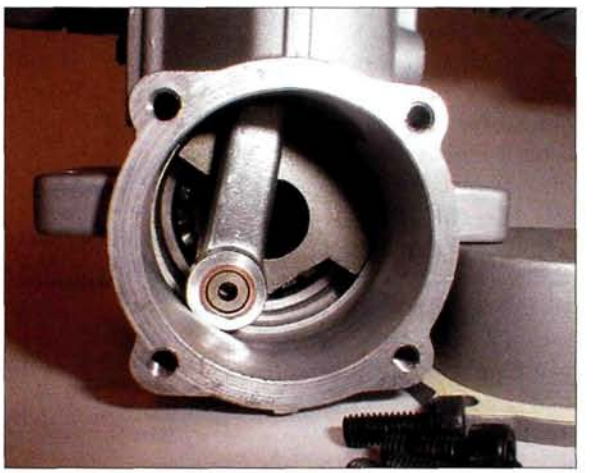
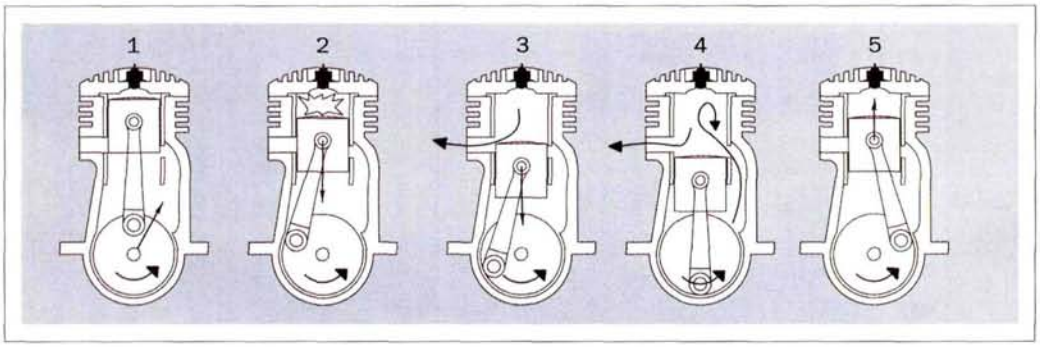


Figure 2 Two-stroke engine operation



1. As the piston reaches top dead center, a new charge of fuel/air mixture is drawn into the crankcase because of the low pressure created by the piston's upward motion.
2. The current fuel/air mixture is then compressed by the piston in the combustion chamber, and it heats up and is ignited by the glow plug. This forces the piston downward.
3. As the piston comes down, it opens the exhaust port, and the spent fuel charge begins to exit the combustion chamber. At the same time, the piston compresses the new fuel/air mixture charge in the crankcase.
4. At bottom dead center, the piston opens the bypass port, and the new fuel-mixture charge flows from the crankcase into the combustion chamber as the last of the spent charge leaves.
5. The piston comes back up and seals the exhaust and bypass ports, and the entire sequence begins again.

the glow plug's condition and replace it if you need to (see the "Reading the glow plug" sidebar).

STARTUP AND BREAK-IN

A just-out-of-the-box, brand-new engine needs special handling before it can be run at peak output. You shouldn't just bolt a new engine to your model and go to the flying field. Some modelers often break in engines while flying their models, but with your first engine, you should play it safe and break it in at home where you have all your tools and supplies. Short, well-lubricated runs break an engine in gently because this allows the parts to fit together and seat gradually.

When you break in an engine, it wears all the parts slowly so that they will match one another precisely. To operate properly, all engines must be broken in, and some engines take longer than others. If you run your engine without breaking it in, it will get very hot because of excessive friction, and the localized heating will damage the internal parts—primarily the piston/sleeve fit.

First, install a new glow plug. Gently snug it down; don't overtighten it, or you could strip out the aluminum threads in the engine head. Fill the fuel tank with a 2-stroke fuel that contains 5 to 10 percent nitromethane and 18 to 20 percent oil. Attach the fuel line to the needle-valve assembly; make sure that the line doesn't kink or touch the engine case, which will get very hot. Attach a propeller of the recommended size, and snug the prop nut down firmly with a 6-inch wrench. Don't use pliers; they will damage the prop nut.

Open the engine's needle valve at least four full turns counterclockwise, and open the throttle sleeve fully. Put your thumb over the air intake, and flip the prop counterclockwise several times until you see fuel start to flow through the fuel line and into the carb. When the fuel reaches the carb, close the sleeve to about ¼ throttle and attach the glow-plug battery. Flip the prop over with a chicken stick or an electric starter until the engine starts to run.

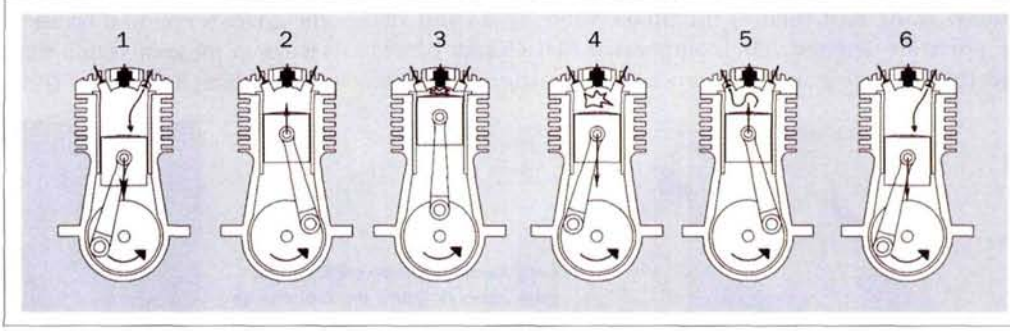
When the engine has warmed up a little, open the throttle all the way and let the engine run at a very rich, low power setting. After about 10 minutes, stop the engine and let it cool completely. Repeat this process several times, and gradually lean the fuel mixture each time by turning the needle valve in (clockwise) a couple of clicks. Don't run the engine at high rpm and at a lean mixture setting until you have run at least six or seven tanks of fuel through it.

You'll know that the engine has been properly broken in when it runs consistently without overheating and transitions smoothly from idle to full throttle. Remember: it's always better to operate your engine a few clicks too rich than a few clicks too lean!

LOW-END SETTING

For your model to land safely, its engine must have a very reliable idle. Some engines have a single-needle valve and a small air-bleed

Figure 3 Four-stroke engine operation



1. **Intake:** the piston comes down, the intake valve opens, and the fuel charge is drawn into the combustion chamber.
2. **Compression:** the piston comes up as the intake valve closes and compresses the fuel charge.
3. **Ignition:** when the piston is at top dead center, the glow plug ignites the compressed fuel charge.
4. The fuel mixture expands rapidly and forces the piston downward.
5. **Exhaust:** the piston comes back up again while the exhaust valve opens and the spent fuel charge is expelled.
6. The piston goes back down, and the entire sequence of events begins again.

"Reading" the glow plug

The pro's monitor how well their engines are running by "reading" their glow plugs; after they've flown their models, they examine the glow-plug's coil.

If an engine has been tuned properly and is running well, the coil will be shiny or a light gray, and its shape will be uniform even after a hard run. The leaner you tune your engine, the grayer and more deformed the coil will be, and these signs warn that you're running your engine too lean! If that's the case, replace the glow plug, richen the fuel mixture immediately, and retune your engine for good performance.

Before you unthread a glow plug, you must clean the area around it. When the engine has cooled, spray a generous shot of fuel around the glow plug to rid the opening of dirt and debris. If you don't do this, you risk having this dirt fall into your engine as you remove the glow plug.

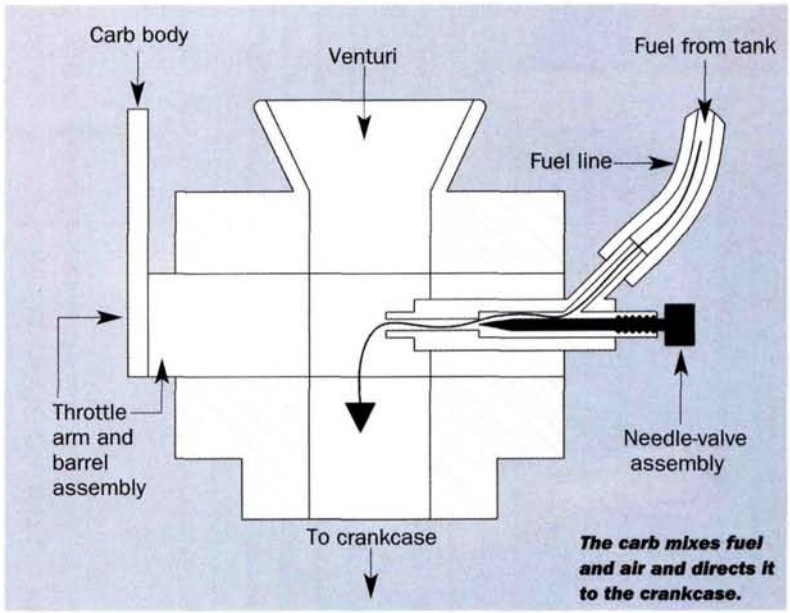
Plug 1. Too lean
This plug came from an engine that was tuned to run too lean. The housing is slightly oil-stained, but the coil is clearly compressed into the housing, so we know it got too hot and was nearly melted by combustion heat. If the engine had continued to run in this condition, the element would have melted and come out of the plug. At that point, you'd be lucky if it just fell out through the exhaust port; it could easily cause some type of internal engine damage.

Plug 2. Normal
Here's what a reasonably fresh plug from a well-tuned engine should look like. The housing is relatively clean, so it hasn't seen too much hard duty, and the coil is shiny and hasn't been deformed by excessive combustion temperatures or hydraulic locking caused by being run with too much fuel.

Plug 3. Too rich
This was taken from an engine that had been tuned with an excessively rich fuel mixture. The deposits on the plug housing and the coil were formed because the plug couldn't burn off all the excess fuel; this would eventually make the engine difficult to start and to tune.

Plug 4. Old and worn
This plug is closer to ideal, but it's old and may fail soon. The lubricants in the fuel and the temperatures generated during combustion lead to glow-plug-housing discoloration. Notice that on the first few coils, the element is relatively clean and a white-ish color. This indicates an optimum to slightly lean fuel mixture. An engine with this plug makes good power, but it might be too lean if there's a slight change in the weather (ambient temperature).

Figure 4 Carburetor breakdown



hole in the carb body that is used for the low-end, or idle, fuel/air mixture setting. Other engines have two needles: a large main needle for the high-end setting and a smaller one for idle. Start with the engine's factory setting; it's usually pretty close to the correct setting. If you bring an engine to idle and it dies, then the low-end, fuel/air-mixture setting is set too lean; you must increase the amount of fuel being drawn into the carb at idle. If the engine settles into an idle but then burbles or dies when the throttle is opened, the low-end mixture is too rich, so you must decrease the amount of fuel that enters the carb at idle. It's a balancing act.

With a twin-needle-valve carb, the idle-needle valve is used to adjust how much fuel enters the carb. In an air-bleed design, the air-bleed screw is used to adjust how much air enters the carb during idle. Both types work well, but the more powerful engines usually rely on the twin-needle-valve carb.

CARE AND MAINTENANCE

If you take care of your engine properly, it will provide maximum power and last for a very long time. This care should begin on the day that you bring it home from the hobby shop. Most engines come with Allen wrenches; keep them in a safe place, and if you lose one, replace it with one of the same size.

An engine-maintenance check begins with the removal of the backplate and a look inside the crankcase for metal shavings and other debris. Also remove the head and check the combustion chamber. Squirt a little 3-In-One oil into the engine, and turn the engine over to lubricate the bearings and the conrod bushings. Make sure that the ports in the sleeve are aligned with the ports in the case.

Reassemble the engine, and tighten the screws in a "crisscross" pattern. Don't use thread-locking compound on the engine-case screws or head screws. It isn't required and will make it more difficult to remove the screws for future maintenance. It can also cause the threads in the screw holes to strip. Just snug the screws down using Allen wrenches and two fingers. Never force any part that won't go on or move easily. An engine is made mostly of aluminum, and it is very easy to strip the screw-hole threads.

After the day's last flight, drain the fuel out of the tank and run the engine dry of fuel. Clean any debris from the engine, especially from the cooling fins around the cylinder; if the fins are blocked, the engine won't cool properly when it is running. Squirt after-run oil into the carb and glow-plug hole to coat the inside surfaces; this helps to prevent corrosion. Alcohol-based fuels attract moisture, and unprotected engine surfaces will corrode—especially the ball bearings. Oil is inexpensive insurance for long engine life.

That's about it! To keep your engine happy, don't run it too lean. With proper break in and maintenance, it will provide you with many hours of carefree flight time, and that's what the hobby is all about!

FLIGHT TEST

Tearing up the sky with a sport-scale American hero

Hangar 9

P-51 Mustang ARF

by Bill Jensen

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

With the gear mods as described in the text, I could taxi, take off and land on thick grass with relative ease, which is saying something with this type of model! One time, however, while I was taxiing slowly downwind, the Mustang hit a bump and caught a wind gust at the same time, and it nosed over.

On the first flight, I kept the nose-over potential in mind, and I held full-up, high-rate elevator for taxiing and the initial takeoff roll. The acceleration is impressive with the Saito 100, so I immediately released some back stick, and in a heartbeat, the ship climbed out briskly and slightly ahead of the pilot! After a couple of trim passes (a few clicks of down and two of right), I pulled the gear up. Now, where's that FW-190?

To prepare for the first landing, I tested the stall at altitude, and I was delighted to see that this bird is not a dreaded "snapper" but stalls very gracefully without any surprises. There was sometimes a slight wing drop at the stall, but it was very mild and controllable. I made an upwind, gear-extension low pass and set up downwind for the approach.

The glide-down final was "on rails" and a round-out, deep flare followed by a 3-point landing was easy and felt natural! Subsequent wheel landings were just as easy.

LOW-SPEED PERFORMANCE

Slow flight, approaches and landing flares were all easy and safe owing to the Mustang's gentle stall characteristics. There wasn't any tendency to snap or to suddenly drop a wing. I could easily recover from intentional, slow-speed stalls by releasing some elevator or by adding power. Rudder and ailerons remained effective at the stall.

HIGH-SPEED PERFORMANCE

This Mustang is fast and scale-like at high speed with the Saito 100, but it is not overpowered. Full-throttle low passes (scale strafing runs) are realistic and exciting, especially with the 4-stroke sound! Victory rolls are axial and gorgeous! Vertical climbs from takeoff are possible but will top out at several hundred feet. Hover is possible but with little reserve power. My ship had a slight throttle-to-pitch coupling and tended to drop the nose more than I like when throttle was decreased from full, so I programmed a 10-percent

The North American P-51 Mustang is probably the most recognizable fighter in aviation history. It was first made famous for helping to win WW II; it racked up more kills than any other Allied aircraft and escorted countless bomber missions home safely. But the Mustang's service history is only part of what has made it an enduring aviation icon. Its classic lines and exceptional performance ensure that this warbird remains appealing, even more than 60 years after it first flew.

throttle-to-elevator mix to correct this. This coupling is caused by the built-in stabilizer incidence, which is 1½ degrees negative to the wing. Full-size craft fly this way, so it is not a defect in the design; I just prefer less power-to-pitch coupling in a model. Setting the stab angle at zero degrees to the wing would probably eliminate this effect without channel mixing. The other option is to increase the engine downthrust, but that would require cowl mods.

PHOTOS BY WALTER SIDAS

AEROBATICS

This bird can do it all gracefully and predictably! On high rates, it can do very tight inside and outside loops without snapping out. I tried all the standard aerobatics, plus spins, snaps, inside and outside, upright and inverted, and I was happy with my first attempts with a new plane—and a sport-scale plane at that! Knife-edges could use some rudder-to-elevator and aileron mix, which I plan to add. This bird features super aerobatics ability and nice scale looks—a great combination!

You have to like how complete many of today's ARFs are. The Mustang comes with all you see here; the construction is first-rate, and the Ultracote is nicely detailed and easy to work with.

Hangar 9 has created a sport-scale model of the great Mustang that really has the look and feel of this famous warbird. With a wingspan of 65.5 inches, it is small enough to fit in a car but big enough to be a serious model, especially with the included retracts!

Many have remarked on how ARFs have improved in quality, price and selection in recent years, and this Mustang certainly benefits from that trend. The kit is complete; all hardware and most of the accessories are included (except prop, spinner, pilot figure, radio and engine). The materials and construction are of high quality; the structure is all wood—balsa and lite-ply—and is expertly covered in Ultracote high-temp film, which makes repairs easy. If you are familiar with precovered planes, you know that some use a proprietary low-temp film that isn't available separately; that means even minor damage requires that you completely recover the model if you want the colors to match, but there are no such worries with Ultracote. The package is rounded off with a nicely detailed manual and a full set of decals, many of which come applied. All this adds up to a topnotch ARF that is worthy of the Mustang lineage.

Retracts come with the kit, but I shimmed them at the rear to give the Mustang better handling on rough grass fields.

ASSEMBLY

The 48-page instruction manual is first class; it is very detailed and easy to follow, contains many photos and assumes little ARF experience. I'll touch on a few specific areas of interest in the assembly rather than restate the procedure step by step.

• **Retracts.** My favorite club field has thick grass. Models of the Mustang's type (scale with long-legged conventional gear) operate easily off paved strips, but they tend to nose over on thick grass. The problem is that, for a true-to-scale model operating off grass, the Mustang's wheels are too close to the CG, and the gear legs are too long. I tried to think of ways to solve this problem, but this model comes built and covered, and the retracts are installed, so moving the gear forward would require a major rework. The molded-plastic wheel wells fit the wheels tightly and don't allow bending or shortening of the struts.

SPECIFICATIONS

MODEL: .60 P-51D Mustang ARF

MANUFACTURER: Hangar 9

DISTRIBUTOR: Horizon Hobby Inc.

TYPE: sport-scale ARF fighter

WINGSPAN: 65.5 in.

LENGTH: 55.75 in.

WING AREA: 745 sq. in.

WEIGHT: 7 to 8.5 lb. (8.25 lb. as flown)

WING LOADING: 21.6 to 26.3 oz./sq. ft. (25.1 oz./sq. ft. as flown)

RADIO REQ'D: 5-channel w/6 servos (for ailerons, elevator, rudder, throttle and retract)

RADIO USED: Futaba 9Z

ENGINE REQ'D: .60 to .78ci 2-stroke or .72 to 1.00ci 4-stroke

ENGINE USED: Saito FA-100GK 4-stroke

PROP USED: APC 14x8

FUEL USED: Cool Power 15% nitro, 20% all-synthetic oil

PRICE: $254.99

FEATURES: Ultracote-covered balsa and lite-ply construction; painted fiberglass cowl and canopy; installed retracts; detailed, photo-illustrated instructions; complete hardware.

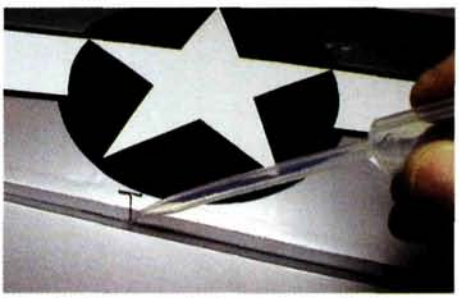
COMMENTS: the Hangar 9 P-51 ARF provides an easy way to break into sport-scale warbird flying—with retracts! Assembly time is minimal, compared with a kit. The Ultracote is well done, and the overall quality and workmanship are quite good. The Saito FA-100 4-stroke gives a spirited, fighter-like performance; a very satisfying project, indeed!

HITS

- Good stability at all speeds.
- Pre-installed retracts, painted cowl and canopy.
- Great instruction manual.
- Nice Ultracote covering and scale details.
- Complete hardware package.

MISSES

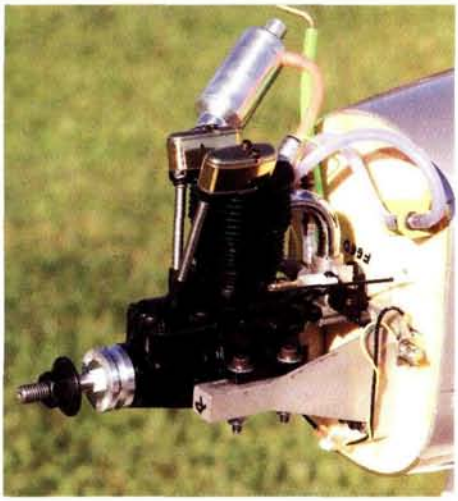
- Tends to nose over on grass.



I used a CA applicator to apply glue to the control hinges. The T-pin ensures that the hinge stays centered. The manual explains this procedure well.

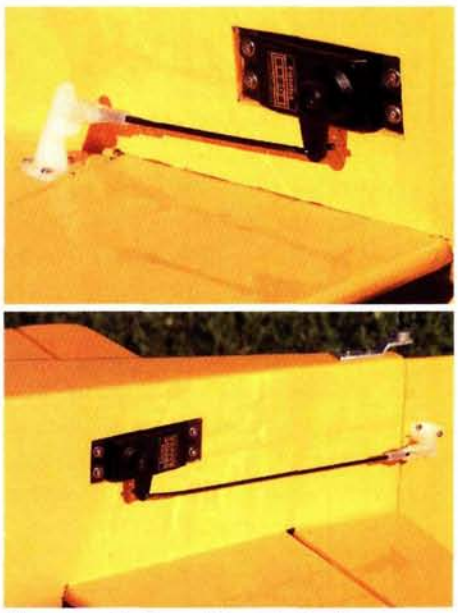
The only easy solution was to shim the rear of the retracts to cant the struts forward while still allowing them to retract into the existing wells. I made two 0.150-inch-thick pine shims to fit under the rear lug, and I installed longer screws. I also moved the battery pack rearward to shift the CG 5 inches back from the wing's leading edge—¼ inch aft of the stock location. These easy mods greatly reduced the nose-over tendency when I flew the model off grass, and I didn't notice any reduction in its excellent flight stability because of my minor CG change.

For the retract servo, I selected the recommended JR (item no. JRPS703) low-profile unit, which fit nicely in the wing servo bay. Even with its substantial 93.2 oz.-in. of torque, this servo still struggles to retract the gear. To ensure reliable gear, I tweaked the retract linkage to avoid all binding and chafing, and I substituted lighter Sullivan SkyLite 3-inch wheels for the provided wheels.



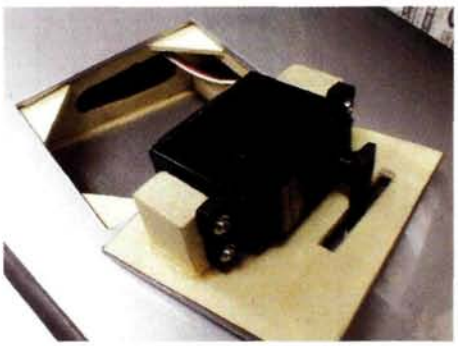
The Saito FA-100GK provides lots of torque for scale-like performance but doesn't overpower the Mustang. The best thing about it, however, is the wonderful 4-stroke sound!

• **Engine installation.** Installing the Saito FA-100 was easy, since the side-thrust and downthrust angles are built into the firewall. I did have to drill clearance holes (⅛ inch deep) in the back of the universal mount to clear the blind nuts that protruded through the firewall. I also had to file the mount's slots to accept the engine bolts. The included tank fit well and was at the correct height relative to the carb's needle valve. Four-stroke throttle linkages can be tricky because of the rear-mounted carb. I made a 180-degree bend in the throttle rod to accommodate a nylon clevis. I also added a Sullivan remote glow igniter and rigged a fuel-line loop outside the cowl so I could fill and drain the tank and to pinch the line to check the mixture. I made the cowl muffler cutout so the cowl can be removed without removing the muffler. Last, I installed a foam pad between the tank and the firewall, and I used Aerotrend colored fuel lines to identify the carb, muffler and crankcase vent lines.



The servos for the rudder and elevator are mounted directly on the fuselage tail. This eliminates the need for long control rods and increases control response, but you will need servo extensions to reach from the radio tray to the tail servos. The throttle servo is mounted conventionally in the radio box.

• **Radio installation and setup.** This couldn't be easier; most of the work has been done for you! The aileron servos are mounted on blocks that are glued to the wing hatches. The elevator and rudder servos are simply dropped into the premade bays in the tail, and the throttle servo is dropped into the provided radio tray. The receiver is secured in the radio tray, and the battery is held by foam padding. I routed the receiver antenna through a nylon pushrod outer tube that I placed inside the fuselage. I installed the retract servo according to the instructions, but I had to cut away material from the wing-root ribs to avoid linkage-rod binding.



The aileron servos are mounted on premade plywood wing hatches—a simple design that does not cause a lot of drag. The blocks are glued into place to fit the specific servos you choose.

I programmed my radio with the low rate set at 70 percent of the high rate. I set the exponential for the aileron at 30 percent and the elevator at 20 percent, and I set the rudder at zero (be careful to use the correct + or – sign for your system!). I set throttle-to-elevator mixing to 5 percent up and down to prevent the nose from dropping when power was pulled back from full.

• **Final details.** I applied the few decals that were not already in place using soapy water to slide them into position. I painted and installed a Hangar 9 ⅐-scale WW II pilot figure, and I positioned the scale exhaust stacks and the painted canopy using PFM flexible adhesive. Last, I checked the CG, balanced the prop and spinner and ran the engine in the plane to make the final needle settings.

SUMMARY

If flying rather than building a retract-equipped warbird appeals to you, this model should be on your list! The time-consuming building and covering has already been done, so this plane can be field-ready very quickly. That said, there was still plenty of opportunity to satisfy my creative urges by customizing the radio

PHOTO BY JOHN DIBBS/THE PLANE PICTURE CO. WWW.PLANEPIX.COM

Flying a Mustang: everyone's daydream

"What's it like to fly a Mustang?" That's like trying to describe the Rocky Mountains to someone who has never seen a mountain. You can describe it all you want, but until they've been there, they just won't believe it.

I've been there. I'm one of the lucky few civilians who has sat there, legs spread wide, right hand wrapped around the contoured control stick and the left hand gripping that Luger-like throttle, while 1,450 British horses yanked me through space like some sort of Harry Potter banshee.

Though I'm only a few notches removed from the average Cessna pilot, my checkout in the Mustang was done in the old-fashioned way: fly a T-6 Texan for a few hours; climb into the single-place Mustang cockpit while an instructor crouches on the wing and points out all the stuff you should know in the cockpit. Then he pats you on the shoulder, and you're on your way.

On my first takeoff, I couldn't decide which was most amazing—the sight of the runway ripping past, the unbelievable noise, or that I was actually flying a Mustang! Somewhere between moving the throttle forward and the runway turning into a gray streak, my nervousness vanished as I focused on keeping the nose straight ahead with right rudder

In what felt like seconds, I was at 10,000 feet. I leaned on the ailerons. The horizon tilted with no effort at all. The nose rips across the horizon, and I'm squashed into my seat. Where is that Messerschmitt I glimpsed earlier? Drop the nose slightly below the horizon. The airspeed needle glides effortlessly past the big three. I'm at 350mph indicated. I pull smoothly and watch the left wing as the horizon twists around it in a loop. Yeehah!

Back into the pattern, I can't get it to slow down without one tight, high-G, 360-degree turn. At 170mph, the gear handle goes down, and there's a satisfying "clunk, clunk." Down and locked.

I turn downwind at 150, slow it to 140 on base and start the rest of the flaps out. The engine barely purrs—125mph. I want 110 over the fence. The airspeed needle settles on the right number, and I drag the rest of the power off. The engine protests. Lots of barks and bangs. It doesn't like to run slowly.

I level the airplane a few feet above the runway and play the "Where is the runway?" game, as I hold it off and rotate it into 3-point attitude at the same time.

A slight bump, then another, and I feel the wheels roll on the asphalt. I can't see the center of the runway, but its edges are in sight. The airplane doesn't want to slow down. I concentrate on making small rudder movements to keep it straight. Then it slows, and I touch the brakes with my toes, and the world again becomes normal. I push forward hard on the stick to unlock the tailwheel and slowly turn onto the taxiway. As I crank the canopy open, the rush of cool air reminds me for the first time that I'm sweating. But, it's the best kind of sweat.

A sudden thought—I've done it! I'm a Mustang pilot, and in my own timid way, I've tasted a little of my heroes' world. And it tastes good. *—Budd Davisson*

Editor's note: Budd Davisson, editor-in-chief of our sister publication, Flight Journal, *has logged more than 6,000 hours as a pilot in nearly 300 kinds of aircraft, including WW II fighters and, of course, the venerable P-51 Mustang.*

and engine installation, for instance, and adding my own detail features. I found the Mustang's flight performance very satisfying; its ability to perform the full range of aerobatics and still imitate a full-scale P-51 in flight is a nice bonus. The model is appealing and nostalgic from a historical perspective, but it sacrifices nothing in terms of modern ARF convenience. Much like the full-size P-51, Hangar 9's Mustang is a supremely capable and stylish aircraft that compromises very little. ✈

Aerotrend Products *(203) 734-0600; aerotrend.com.*

APC Props; *distributed by Landing Products (530) 661-0399; apcprop.com.*

Cool Power; *distributed by Morgan Fuels (205) 347-3525; morganfuel.com.*

Futaba Corp. of America; *exclusively distributed by Great Planes Model Distributors Co. (800) 682-8948; futaba-rc.com.*

Hangar 9; *distributed by Horizon Hobby Inc.*

Horizon Hobby Inc. *(800) 338-4639; horizonhobby.com.*

JR; *distributed by Horizon Hobby Inc.*

PFM; *distributed by Hobby Lobby (615) 373-1444; hobby-lobby.com.*

Sullivan Products *(410) 732-3500; sullivanproducts.com.*

.30-size aerobatic ARF

Yellow Aircraft

CAP 232

by Stan Kulesa

The French have made numerous contributions to aviation, and the CAP 232 is certainly among the most noteworthy. A revised version of the CAP 231 EX, the full-size CAP 232 featured a state-of-the-art wing that was stronger, stiffer and lighter than that found on the 231. The lighter wing produced less inertia for improved handling characteristics and enhanced precision performance.

Yellow Aircraft's almost-ready-to-fly CAP 232 is a nicely built and finished .30-size reproduction of that now legendary aerobat, and its outstanding aerobatics capabilities accurately reflect those of its full-scale counterpart. For those who want a bit larger aerobat, Yellow also offers its CAP 232 ARF in 1.20- and .60-size versions with various trim schemes.

PHOTOS BY STAN KULESA

TAKEOFF AND LANDING

Ground handling is excellent on a paved runway. At ½ throttle, the tail rises after about 20 feet, and with gentle up-elevator, it's airborne. The CAP requires nominal trim adjustments (two clicks of down-elevator and one click of right aileron) to achieve straight and level flight.

Landings are fairly easy; I line the model up with the end of the runway, decrease to about ¼ throttle, and the plane settles right in. When the wheels touch ground, the tail stays in the air for about 25 feet and then slowly drops.

LOW-SPEED PERFORMANCE

All surfaces remain very reactive at slow speeds. I brought it up to a safe altitude to test for stall characteristics. As expected, the nose dropped; there was no tendency to tip-stall.

HIGH-SPEED PERFORMANCE

The CAP's high-speed performance is impressive. It tracks solidly, even in a 15mph crosswind.

AEROBATICS

I was exceptionally pleased with the Yellow Aircraft CAP 232's aerobatic performance. Powered vertical maneuvers are flawless, and with the O.S. Max .32 SX, the model can easily perform 150-foot loops. Stall turns are crisp with full rudder deflection. Split-Ss and Immelmann turns are also clean.

With the throws set per the manufacturer's recommendations, the roll rate is about once every two seconds; the rolls remain true to the axle.

Spins and snap rolls are very brisk and tight. Inverted flight requires a little down-elevator, and though inverted loops are not quite as large as those performed right-side up, the CAP 232 steadily holds knife-edge flight (in both directions) over the entire length of the runway, with no unwanted pitch or yaw.

THE KIT

The Yellow CAP 232 ARF comes in a very complete package that includes a fiberglass cowl, wheel pants, a vacuum-formed canopy, aircraft-grade aluminum landing gear, a complete hardware package, a nylon spinner, a fuel tank, an engine mount and decals. Each major piece is individually packaged in a clear plastic bag, and every part is easy to identify. The 19-page manual is easy to read, well laid out and full of high-quality illustrations. You have only to supply the engine, radio, prop and fuel tubing to get it into the air.

ASSEMBLY

Wing. Assembly of the CAP moves very quickly. It begins with the installation of the aileron servos in each wing panel; they are set inside plywood trays. Following the instructions, I snaked the servo leads through the center section of the wing; they exit the wing through the holes on top.

Connect the wing halves using the supplied plywood joiner. I applied Zap Glue's 30-minute Z-Poxy to the joiner and root ribs for a solid bond and used 1½-inch-wide pieces of fiberglass tape to help strengthen the wing joint. I cut away some of the covering and then used Zap thin CA to attach the fiberglass tape to the wood. When the assembly had dried, I sanded the tape and ironed the included strips of covering over the fiberglass to hide it. Four pinned nylon hinges attach each aileron to the wing; all of the hinge slots come cut. Though the bottom tapers up to the wingtips, the wing has no dihedral. The entire structure is very solid; I even attempted to twist the panels, and there was absolutely no movement.

Fuselage. The fuselage is constructed mainly of ⅛-inch plywood and contains five formers in addition to the firewall. The first step in the assembly of the fuselage is to attach the one-piece aluminum landing gear. I attached it to the bottom of the fuselage with the four provided screws. The screws pass through a plywood plate and are held in place with blind nuts. The provided 2-inch wheels fit nicely in the wheel pants, but ⅝ inch of the wheels remains exposed, and this can be problematic if you take off from a grass runway. In addition, the color of the wheel pants does not perfectly match the trim on the rest of the model, so for both these reasons, I eventually removed the wheel pants altogether. According to the owner's manual, the axle and some epoxy are supposed to hold the wheel pants in place, but I was not completely comfortable with this arrangement, so I added a 2-56 screw and locknut to further secure each wheel pant to the gear.

Next, I used 5-minute Z-Poxy to attach the stabilizer and fin to the fuselage. The owner's manual does a good job of explaining how to properly align the stabilizer. Six pinned nylon hinges secure the elevator halves, and three hinges hold the rudder in

A shock-absorbing tailwheel assembly should be mounted on the aft end of the fuselage. The control linkages for the tailpieces include a Y-shaped pushrod for the elevator halves and a single pushrod to control the rudder.

SPECIFICATIONS

MODEL: CAP 232

MANUFACTURER: Yellow Aircraft Intl.

TYPE: .30-size aerobatic ARF

WINGSPAN: 54 in.

WING AREA: 491 sq. in.

WEIGHT: 5 lb., 6 oz.

WING LOADING: 25.29 oz./sq. in.

ENGINE REQ'D: .25 to .32 2-stroke or .40 to .52 4-stroke

ENGINE USED: O.S. Max .32 SX

PROP USED: APC 9x6

RADIO REQ'D: 4-channel w/5 servos (rudder, elevator, throttle and 2 ailerons)

RADIO USED: Airtronics RD 6000 Super radio w/2 Airtronics 322 (ailerons), 2 Airtronics 743 (rudder and elevator) and 1 Tower Hobbies TS-53 servos (throttle)

FUEL USED: Cool Power 15%

PRICE: $139

FEATURES: built up lite-ply and balsa construction; MonoKote covering; one-piece fiberglass cowl and wheel pants; aircraft-grade aluminum landing gear; package also includes a vacuum-formed canopy, a nylon spinner, a fuel tank, an engine mount, decals and a complete set of hardware.

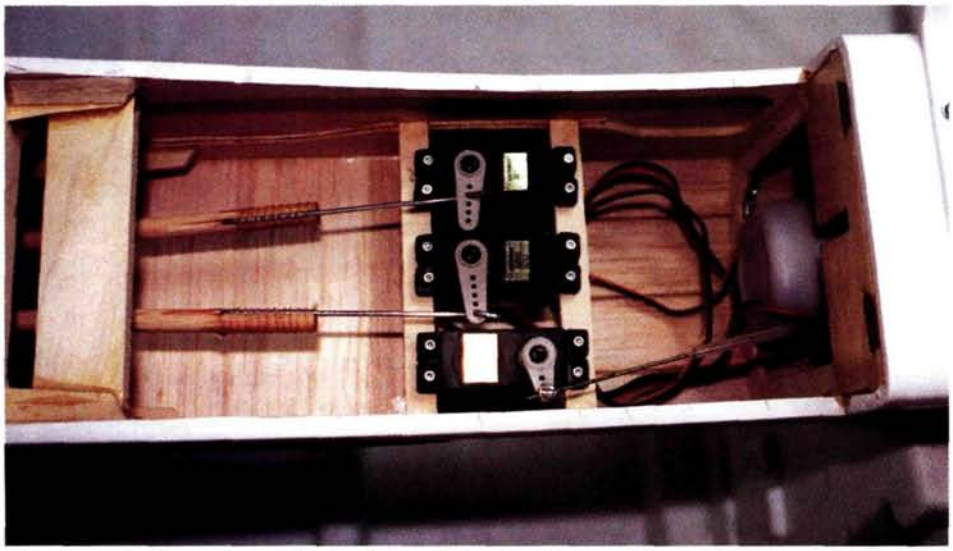
COMMENTS: this is a very complete kit, so you needn't supply much else. When finished, it's beautiful to look at and a joy to fly.

HITS

- Assembles quickly.
- Exceptional aerobatic performance.

MISSES

- Wheel pants' color did not match the model's trim.



There's plenty of room to work inside the fuselage. The elevator, rudder and throttle servos are mounted on rails that come already installed in the fuselage.

place. The shock-absorbing tailwheel assembly should be mounted on the aft end of the fuselage.

Six screws hold the cowl on the fuselage. I cut holes in the cowl to accommodate the glow plug, needle valve and remote-fueling valve. (I used a Du-Bro Kwik Fill fueling valve.) The engine's stock muffler fit well, so there was no need to cut away much of the cowl to provide an opening.

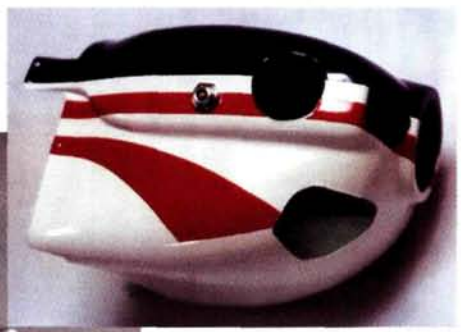
RADIO INSTALLATION

The CAP 232 requires five servos: one for each aileron, one for the elevator, one for the throttle and one for the rudder. Radio installation is pretty simple, and there's enough room to work inside the fuselage. I used my Airtronics RD 6000 Super system with 322 servos for the ailerons and 743 servos for the elevator and rudder. (The 743 servos have a bit more torque than the standard servos.) An inexpensive but reliable Tower Hobbies TS-53 universal standard servo controls the throttle.

Following the instructions, I mounted the rudder, elevator and throttle servos to the rails that come glued to the fuselage sides. The battery pack fits neatly under the fuel tank. I installed the receiver between the battery and the servos and ran the antenna along the bottom exterior of the fuselage.

Next, I installed the hardwood pushrods for the elevator and rudder. The elevator pushrod has two threaded rods that form a "Y" on the control surface end and are connected to the horns on each of the elevator halves. The rudder has one threaded rod, and a Nyrod controls the throttle.

The instruction booklet clearly states how much throw each control surface should have, and when followed, these directions produce excellent flight results. I had to add 6 ounces of weight in the nose to balance the model.



Above: the CAP 232 comes with a one-piece fiberglass cowl; the colors nicely match those on the airframe.

Left: I used an O.S. Max .32 SX with its stock muffler; it's the largest engine recommended, but it still fit neatly beneath the cowl and required minimal carving.

ENGINE INSTALLATION

I decided to power my CAP 232 with an O.S. Max .32 SX 2-stroke engine swinging an APC 9x6 nylon propeller. To allow the muffler to pass beneath the firewall, I side-mounted the engine. Although a 2-inch red nylon spinner comes with the kit, I chose to use a 2-inch Tru-Turn standard aluminum spinner instead. The CAP also comes with a 7-ounce fuel tank, but for increased flight times, I recommend that you install a larger tank. This may require very minimal carving, but there's room. The firewall was fuelproofed at the factory.

I also replaced all of the metric screws and nuts that came with the CAP with 4-40 socket-head screws and locknuts.

FINISHING

The model comes covered and trimmed in white, light and dark blue, red, orange and yellow iron-on fabric. The covering job is quite impressive; there were no ripples or waves in the trim when it arrived.

Instead of using screws to hold the tinted canopy in place (as suggested in the owner's manual), I glued it on with Formula 560. I also added a 1/5-scale Williams Bros. civilian pilot bust. The stick-on decals provided did an awesome job of dressing up the model, although the upper rudder decal was a bit too large for the designated area.

CONCLUSION

This is a very handsome model, but its exceptional flight performance is clearly its most impressive feature. If you're in the market for a .30-size aerobat, check out this CAP. If you decide it's for you, seriously consider installing the largest engine possible; you'll thoroughly enjoy—and be pleasantly surprised by—the wider range of vertical maneuvers.

Airtronics *(714) 978-1895; airtronics.net.*

APC Props; *distributed by Landing Products (530) 661-0399; apcprop.com.*

Cool Power; *distributed by Morgan Fuel (800) 633-7556; morganfuel.com.*

Du-Bro Products *(800) 848-9411; dubro.com.*

O.S. Engines; *distributed by Great Planes Model Distributors Co. (800) 682-8948; osengines.com.*

Tower Hobbies *(800) 637-4989; towerhobbies.com.*

Tru-Turn; *distributed by Romco Mfg. (713) 943-1867; tru-turn.com.*

Williams Bros. *(805) 534-1307; williamsbrosinc.com.*

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Zap Glue; *distributed by Pacer Technology (800) 538-3091; zapglue.com.*

by Dave Garwood

PHOTOS BY DAVE GARWOOD

Dymond Modelsports

Robbe Concorde

Hot electric performance

The Robbe Concorde grabbed my attention the moment I saw it in the "hotliners" section of the Dymond Modelsports website. Its sleek appearance and promise of high-speed performance made me decide, "This is my next plane." It has a molded airframe and colorful finish, so you need only hinge the control surfaces, install the control linkages and wire the motor and speed control. On top of this, the Concorde is an excellent flyer whose twin motors help it cover a lot of sky quickly. It's also capable of some impressive aerobatics.

The Concorde comes with a well-engineered, injection-molded-foam airframe and control surfaces; precut Depron foam vertical fin and fuselage strake parts; a large decal sheet with both British Airways and Air France markings; two Speed 400 motors and pusher propeller assemblies; control-surface linkage wires, tubes, horns and small hardware; six radio-frequency noise-suppression capacitors; motor wire; and a photo-illustrated, 24-page construction guide and flight-prep instructions.

CONSTRUCTION

Construction consists mainly of gluing together molded-foam parts of the airframe, cutting off and hinging molded aileron and elevator parts and installing and wiring the propulsion and RC systems. The work goes smoothly and easily, and if you plan for periods of overnight drying and curing, it can be completed in five, 1- to 2-hour evening sessions.

A note on choosing adhesives: if I understand the Robbe instructions, the factory calls for CA and epoxy to assemble the kit. My experience with Goop glue on previous EPP-foam kits has led me to trust this tough, sticky glue to attach airframe parts, install control cables and hold wires in place. I have no reason to think that CA glue won't work, but I know cured CA is brittle while Goop is flexible and, in my experience, flexible adhesives resist landing damage better. Per the instructions, I used epoxy for the hinges and Depron foam parts (Goop will melt Depron foam).

The Dymond Modelsports website recommends the Hitec Focus SS III radio for this model, so I ordered one. The single-stick SS III is a perfect match for a delta-wing electric model, as it can mix aileron and elevator channels and has a third slider switch channel for motor speed control. It's very inexpensive for a transmitter that has a mixing function.

IN THE WORKSHOP

All righty then. Got your tools and materials? Understand the instructions? Familiar with the order of battle for building? Then let's build the Concorde.

• **Evening 1.** Glue the nose cone and tail cone halves together with Goop, keeping the parts aligned with masking tape. Cut the elevators and ailerons away from the molded wing with a sharp hobby knife, and clean up the edges with sandpaper. Assemble the hinges and drill holes to receive

SPECIFICATIONS

MODEL: Concorde

MANUFACTURER: Robbe

DISTRIBUTOR: Dymond Modelsports

TYPE: high-performance electric twin

WINGSPAN: 32 in.

WING AREA: 420 sq. in.

WEIGHT: 2 lb.

WING LOADING: 11 oz./sq. ft.

RADIO REQ'D: 3-channel w/elevon mixing and 2 servos

RADIO USED: Hitec SS III transmitter and two Futaba S-3003 servos

DRIVE SYSTEM INCLUDED: two Speed 400s w/props

PRICE: $119

FEATURES: injection-molded-foam airframe and control surfaces; Depron foam vertical fin and fuselage strake parts; British Airways and Air France decals; two Speed 400 motors and pusher-propeller assemblies; hardware; photo-illustrated instructions.

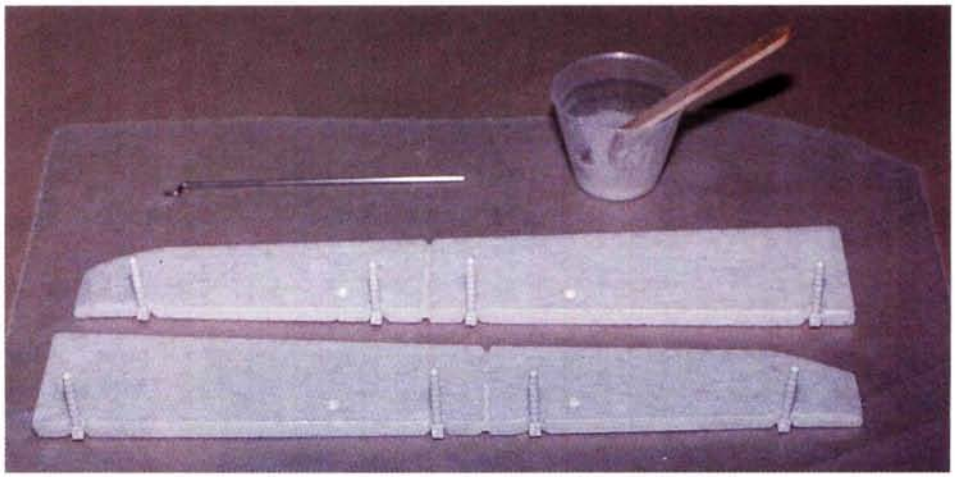
COMMENTS: the Concorde is a terrific design that comes with high-quality materials, is easy to construct and has excellent flight performance. I'm very happy with my model.

HITS

- Ease of construction.
- High-quality materials.
- Excellent flight performance.

MISSES

- None.



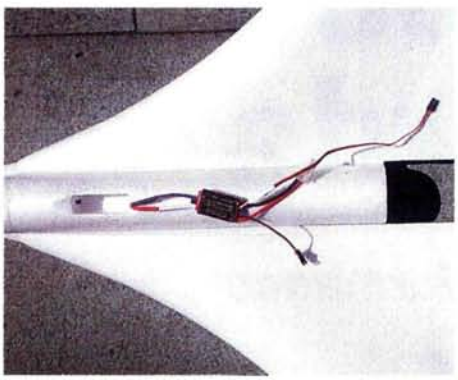
An excellent construction technique that's specified in the Robbe instruction manual is to install the hinge points in two steps; first, with the hinges bent 90 degrees to ensure correct alignment, and then into the wing. The adhesive used is epoxy with microballoons mixed in to make it white. Use a wire to get the epoxy down into the drilled holes.

the hinge points in the control surfaces. A 7/64-inch-diameter drill bit works if you don't have the 2mm drill bit that the instructions specify. Mount the hinges in the control surfaces with epoxy. The kit instructions mention an excellent procedure for aligning the hinge angles: bend the assembled hinge points 90 degrees, and point them upward while one side cures. Set these assemblies aside to cure overnight.

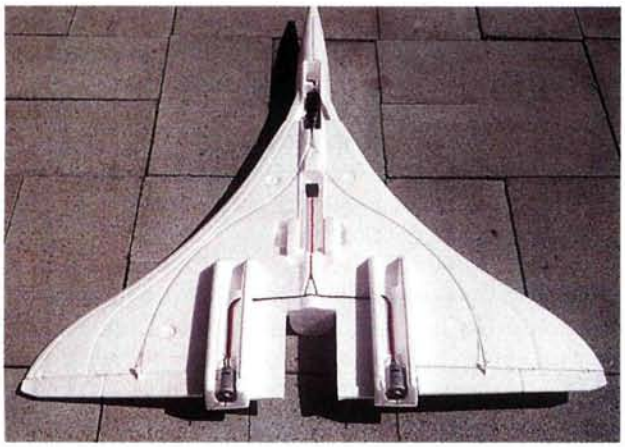
• **Evening 2.** Drill holes for the hinge points in the trailing edge of the wing, and install them with epoxy. Glue the nose cone to the front of the fuselage with Goop adhesive, holding it in place with masking tape. Set it aside to let the epoxy and Goop cure overnight. Skip ahead in the instructions, and solder the radio noise-suppression capacitors and the power leads to the motors.

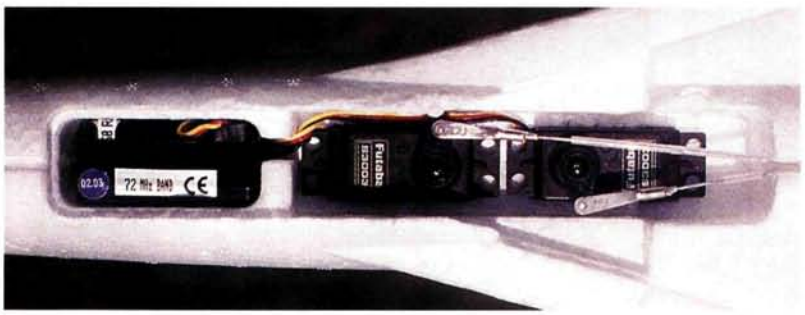
• **Evening 3.** Install the control cables and servos. I mounted a pair of Futaba S-3003 standard servos, which fit perfectly into the molded pockets, with a small smear of Goop on each side of the servo.

Though the control wires slide easily inside their tubes on the bench, fitting them into the serpentine slots that are molded into the wings causes them to generate enough friction that I was glad I'd decided to mix aileron and elevator function in the transmitter, and thus installed only two control cables instead of four. If you use a transmitter that doesn't have elevon mixing, and you need to install four control cables, consider using a light, flexible, braided control cable, such as Sullivan no. 507, to reduce friction loads on the servos. Install the control cables



Right: the upper side of the Concorde, showing the placement of the ESC bay.
Below: the underside of the Concorde, showing the motor installation and wiring, servo installation and control cables.





A closer view of the receiver and servos installed in molded pockets and the author's clevis installation. The fit on the molded pockets is excellent.

TAKEOFF AND LANDING

The first launch was made with the assistance of a helper, so I could keep both hands on the transmitter. With full power applied and a mighty overhand heave into the wind with the model pointed level (not up), the plane descends slightly and gathers speed rapidly.

On about half of my landings, one or both props pulled off, as they are designed to do. The props don't break, but the hubs become distorted and grip a little more loosely each time they're re-mounted, and eventually, I threw a prop in flight. The plane landed fine with one prop, but props break under normal use, so I suggest that you order some spares for long-term happiness with the airplane (also see the "Aftermarket Add-Ons" sidebar). On one hard landing, I crushed the Depron foam engine-nacelle covers, so I replaced them with 3mm Coroplast—a little tougher material (1/16-inch plywood would work, as well).

LOW-SPEED PERFORMANCE

With power off, it just slows down to walking speed and "mushes" without stalling until you release the back stick pressure. This gentle and predictable low-speed performance was amazing to me for such a fast, high-wing-loading plane.

HIGH-SPEED PERFORMANCE

With gentle backpressure on the elevator stick, the plane climbs quickly at a 30-degree angle and covers quite a bit of ground as it ascends.

AEROBATICS

Enter a loop from a dive, and the Concorde performs graceful loops of about 150-foot diameter. Stall behavior is exemplary; the plane slows down under full control to a remarkably slow airspeed. With power on, it will handle a 35-degree angle of attack before the nose falls straight ahead, and it recovers after descending 15 to 20 feet and regaining flying speed. Rolls are quick and axial, and inverted flight is not great; it was difficult to hold altitude while inverted.

The flight testing included some air time at the NEAT Fair e-flight extravaganza in upstate New York, where I flew three flights that included fast climbs, fast passes, fast rolls, repeating loops and Cuban-8s. I heard many positive comments from onlookers.

AFTERMARKET ADD-ONS

In my experience, the Concorde is underpowered with a 6-cell pack, flies well with a 7-cell pack (and is even speedier in climb and cruise), and it pulls tighter loops with an 8-cell pack. Pack capacity is the pilot's choice; you'll trade heavier weight for longer flights.

After about 30 flights, I mounted larger, 6-inch-diameter plastic props from Windrider Aviation on the Concorde; these added some punch to the plane's performance. Currently, my favorite setup is the Dymond 1300mAh flight pack with the Windrider 6-inch propellers; these allow the plane to sustain a 45-degree climb to out-of-sight altitude in about 30 seconds. The Concorde will pull Immelmann turns from level flight, fly repeated Cuban-8s and consecutive loops, and with this power and reduced trailing-edge reflex, it will maintain inverted flight.

with Goop or CA, hold them in place with masking tape strips, and let the cable installation set up overnight.

• **Evening 4.** Complete the wiring harness, including the ESC, and install the wiring in the airframe. Plenty of high-current wire is included in the kit, and the wiring instructions are crystal clear. The receiver is too far away for the stock D-35 ESC lead to reach, so you'll need a 12-inch extension cable. You may also cut off the short receiver lead and solder on a portion of a heavy-duty aileron extension cable, such as Expert Electronics no. EXRA 130, to eliminate a connector.

I used Goop in several spots to hold the wires in their slots. Before you quit for the night, glue the tail cone and ESC motor-controller hatch into place with Goop, secure the parts in place with masking tape while the glue dries, and mount the control horns with epoxy.

• **Evening 5.** Gently round the edges of the vertical fin, engine nacelle bottom covers and fuselage canards with sandpaper and install them with epoxy. Decide whether you're going to tape the servo compartment cover into place or glue it on. If you glue it, install the spruce stick stiffener on the underside of the front fuselage.

AT THE FIELD

While you charge the flight battery pack, apply the press-on markings to the airframe. Install the flight battery, and carefully balance the plane at the point indicated. Remember that a nose-heavy plane is sluggish; a tail-heavy plane is twitchy. Double-check that control-surface movement is "correct and free." Now you're ready to head for the flying field. I painted the end of the engine nacelles with Testors Model Master enamel paint and added panel lines with a Sanford Sharpie Ultra Fine Permanent Marker, using the box illustration as a guide.

I'm really happy with my Concorde—my introduction to hotliner e-flight. It has exceeded my expectations in design quality, materials selection, ease of construction, flight performance and—now that I have more than 45 flights on the plane—in long and durable service life.

Dymond Modelsports *(858) 495-0092; rc-dymond.com.*

Expert Electronics; *distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.*

Futaba; *distributed by Great Planes Model Distributors (800) 682-8949; futaba-rc.com.*

Hitec RCD *(858) 748-6948; hitecrcd.com.*

Sullivan Products *(410) 732-3500; sullivanproducts.com.*

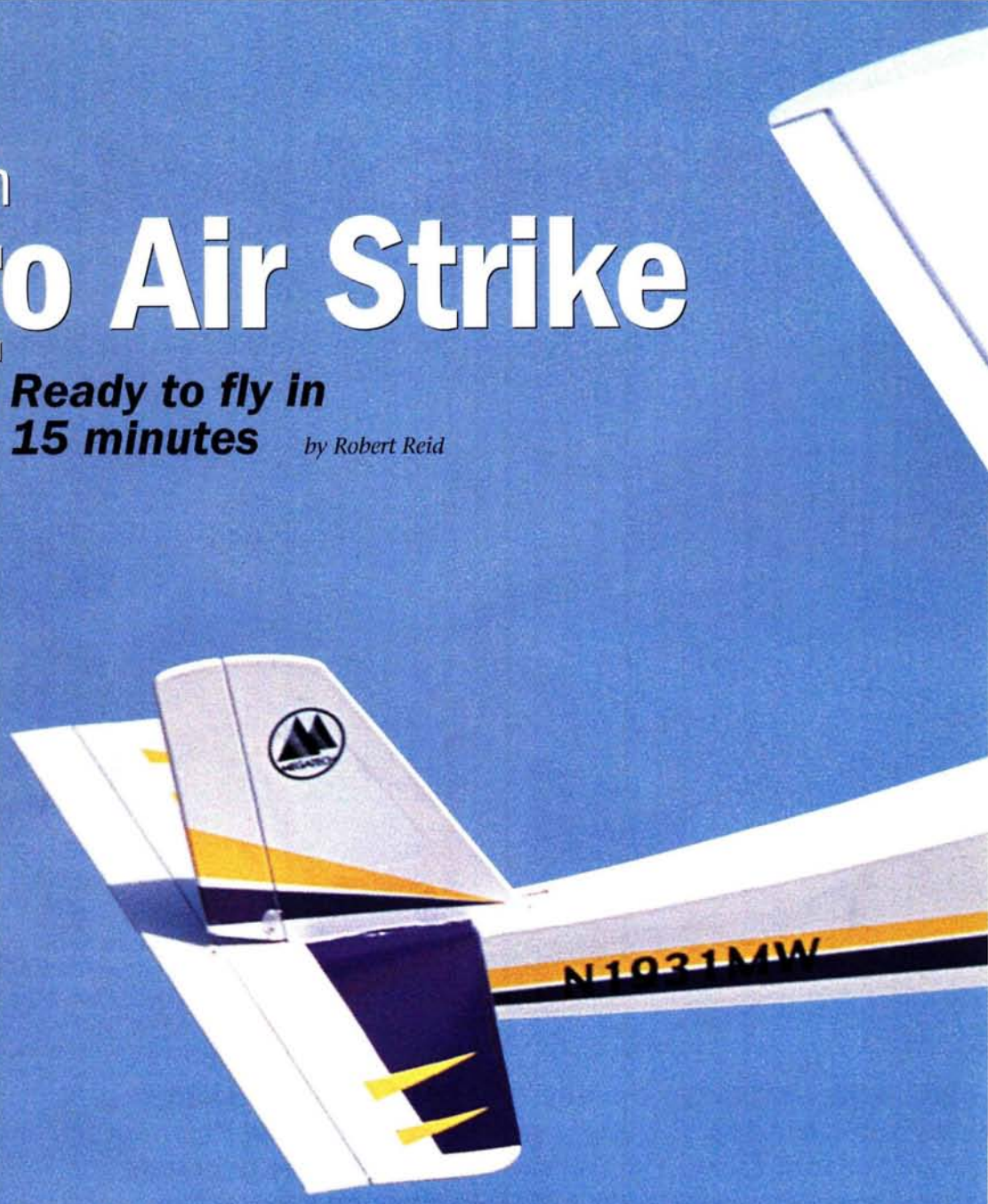
Testors Corp. *(815) 962-6654; testors.com.*

Windrider Aviation; *windrider.com.hk.*

Megatech Nitro Air Strike RTF

Ready to fly in 15 minutes

by Robert Reid



When I first started RC flying, I used to listen to the other fliers talk about how easy or difficult a kit was to build. Someone once boasted that his kit was so easy to build, he had only to "... put a bottle of glue in the box, shake it up and pour out the plane—already built." Megatech has gone this jokester one better; with its ready-to-fly (RTF) Nitro Air Strike, you won't even need glue.

I wanted a trainer plane that would help me teach my grandson to fly, and the Nitro Air Strike certainly fits the bill. I couldn't wait to get started on this kit and take my grandson out flying.

SPECIFICATIONS

MODEL: Nitro Air Strike RTF

MANUFACTURER: Megatech

TYPE: trainer

WINGSPAN: 61 in.

WING AREA: 686.5 sq. in.

WEIGHT: 5.31 lb.

WING LOADING: 17.82 oz./sq. in.

LENGTH: 46.5 in.

ENGINE INSTALLED: Megatech M-46 ABC 2-stroke

RADIO INSTALLED: Airtronics VG 400 w/4, 94102 servos, a 92777Z 7-channel receiver and 700mAh Ni-Cd battery pack

FUEL USED: Performance Plus

PROP USED: Master Airscrew 11x6 (included)

PRICE: $329

FEATURES: balsa and plywood airframe covered with heat-shrink material; installed M-46 ABC ball-bearing engine and Airtronics VG 400 radio; 15- to 20-minute assembly without any tools.

COMMENTS: instructors and students alike will enjoy flying this plane.

HITS

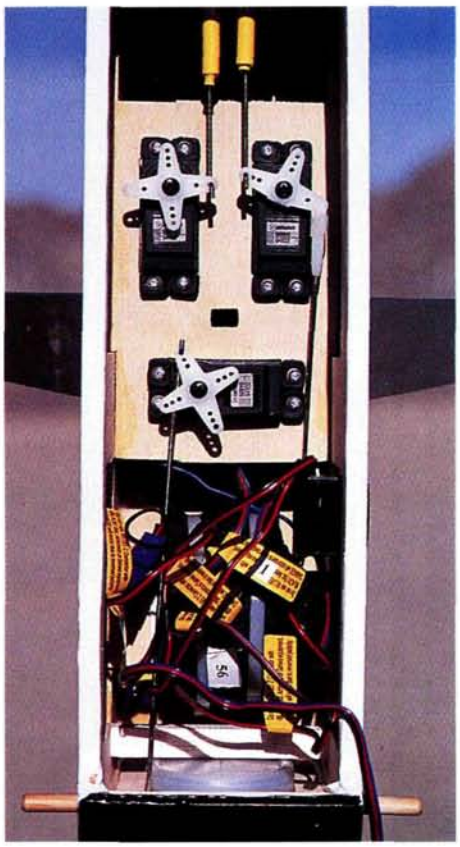
- Excellent trainer performance.
- High-quality construction.
- Everything is installed.

MISSES

- Wing joint on my model was loose.

Inside the box, you'll find an all-wooden trainer with wings, stabilizer and fin packed in plastic bags. The radio and engine are covered in bubble wrap and have been installed in the fuselage. The plane is covered with a heat-shrink plastic film to which the decals have already been affixed. A four-page instruction manual with 17 photos details the very simple assembly. According to the manual, the assembly should take 15 minutes; I did it in 20 (I spent 5 minutes reading the instructions!). The installed radio is an Airtronics VG 400 4-channel system with a 7-channel 92777Z receiver, battery, switch harness and four 94102 standard servos. The engine is Megatech's M-46 ABC with muffler.

Above: the Nitro Air Strike brings new meaning to the term "ready-to-fly." It comes out of the box just as you see it here. Below: all of the radio gear comes installed. There is absolutely no work to be done on this part of the plane.



ASSEMBLY

Very little assembly is involved; in fact, I spent more time removing the few wrinkles with my heat gun than I did actually building the model. The entire plane can be assembled without using tools because all of the components are attached with bolts and wing nuts.

Tail feathers and landing gear. The vertical fin has two factory-installed attachment bolts. You will need to insert these through the two holes in the horizontal stabilizer and then through the two holes in the stabilizer plate (at the rear of the fuselage) to pass through the fuselage to the bottom. Secure the fin/stabilizer with the included wing nuts, attach the pushrods to the elevator and rudder, and you're finished with the tail assembly. Wow; that took all of 2 minutes!

The next step is to attach the sturdy aluminum landing gear, to which the wheels are attached, to the underside of the fuselage. Turn the fuselage over, and insert the landing gear onto the three studs that protrude from the fuselage; then fasten it with the three wing nuts. That takes care of the gear.

Wing. I assembled the wing by joining the two wing panels to the laminated plywood-aluminum wing spar that's fastened into place with wing bolts. A ¼-inch alignment dowel at the trailing edge keeps everything straight. The holes for the wing bolts are on the bottom of the wing halves and are covered with film. You'll have to feel for the film and use a hobby knife to cut out an access hole. After I had assembled the wing, I noticed an ⅛-inch gap between the panels, so I covered it with a piece of trim tape.

The aileron servo comes mounted on the left panel, and the left pushrod has already been attached. The right aileron pushrod is zip-tied to the left one for shipping; I cut it loose with a pair of wire cutters (the only tool I used for the entire assembly) and attached it to the right aileron control horn.

Fuselage. Not much to do here; Megatech has already installed the servos and wooden pushrods for the elevator and rudder.

A RADIO TO GROW WITH

The Airtronics VG 400 system included with the Megatech Nitro Air Strike is a great radio system for beginner pilots, but it can also be installed in other planes as student pilots advance.

This radio system includes a 92777Z 7-channel, dual-conversion receiver, four 94102 heavy-duty standard servos, a 700mAh Ni-Cd battery and a switch harness.

The VG 400 system has separate endpoint adjustments on both high and low throttle, and this makes idle and high-end adjustments a snap. Servo installation in another plane is not a concern, thanks to the servo-reversing switches on all four channels.

FLIGHT TRAINING

A trainer cord, available separately, can be used with just about any Airtronics system, thereby making it easy for new pilots to find instructors at the flying field. The trainer cord is attached from the plane's transmitter to another Airtronics transmitter that the student will use (it can be on any frequency). Only the transmitter that the instructor has is turned on. When the trainer button is pressed and held down, the student's transmitter will control the plane. If the instructor has to take control of the plane for any reason, he or she need only release the training button to resume control of the plane.

An important consideration with the Airtronics training system is that all of the controls for the trim tabs, endpoint adjustments and servo-reversing are transferred to the student's transmitter. That means that the student's transmitter must be trimmed out to match the instructor's. Always do a preflight check by pressing the training button and watching all the control surfaces for movement; then work the sticks to make sure that all the control surfaces have the correct throws and movements.

Considering all of the extra features, the VG 400 is an excellent stand-alone radio system. (If you wish to purchase the system separately, it's available from Airtronics for $221.95.) That Megatech decided to include it with the Nitro Air Strike plane makes this RTF package an outstanding deal.

FLIGHT PERFORMANCE

Flying the Nitro Air Strike made for a fun day. My grandson and I were at the field early. It was a perfect day—clear, with no wind. After I had checked all the controls to make sure that they responded in the correct directions, I did a quick range check, and we were ready to go.

TAKEOFF AND LANDING. Taxiing out to the runway, I found the steering quite sensitive and almost rolled the wingtips into the dirt a couple of times. When I had the plane lined up with the runway, I slowly applied full throttle. The Air Strike started down the runway, and after about 50 feet, I eased in some up-elevator, and the plane broke ground. It showed no tendency to dip a wingtip, and it stayed level in a nice, steady climb. After reaching a safe height, I turned the plane back toward me. The turn was nice and smooth, and the plane leveled out after I released the controls. I adjusted the elevator trim with some down to stop climbing; the aileron trim was right on. After making a couple of turns around the field to get the feel of the plane, I set up for some practice landing approaches. After a few low-speed passes over the runway, it was time to land the plane at last.

Setting up on the downwind approach, I went to ½ throttle and gradually lost altitude. Turning on base, I cut the throttle a little more; the plane maintained a nice, level descent. I turned into the final approach and cut to ¼ throttle. The plane showed no tendency to drop a wing but continued a nice, flat glide path. Once over the runway edge, I pulled back to a full idle, and the plane settled into a soft landing. It almost lands itself.

SLOW-SPEED PERFORMANCE. The Nitro Air Strike is a trainer plane, and as such, it handles very well at slow speeds. The plane is very docile, and all of the controls respond well with very little air passing over them. When the plane does stall, it is very gentle and straight-ahead with a slight wing drop to the left—easily corrected with some rudder.

HIGH-SPEED PERFORMANCE. Though the Nitro Air Strike moves out with the M-46 engine, it is no speed demon. But for a new pilot like my grandson, the plane has plenty of speed. During most of his flying time, we flew it at ¾ throttle.

AEROBATICS. This plane is a trainer, but I wanted to see whether it would do any type of aerobatics. On my next flight, I did a split-S, a loop and a roll. The plane performed the first two stunts well, but the roll is very slow, and you need to input down-elevator when it is inverted to keep it level. I then cut the throttle to an idle to see whether it would stall; it just mushed along and kept flying. I flew it inverted but needed a lot of down-elevator to keep it level; the flat-bottom airfoil and dihedral wanted to return the plane to the upright position—a good thing in a trainer.

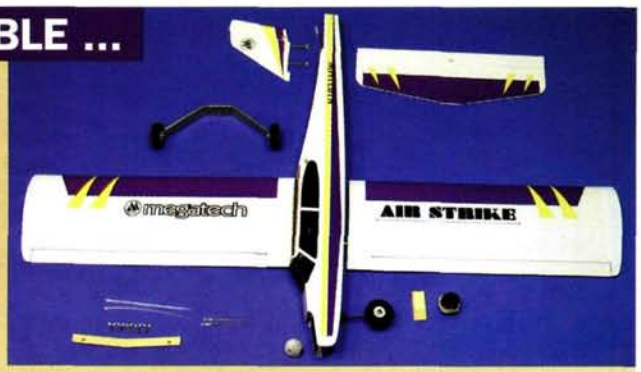
You need only attach the clevis after you've attached the tail feathers. An Airtronics 7-channel receiver and flight battery pack comes already installed, wrapped in foam and held to the plywood tray with a zip-tie. The throttle servo comes installed, and the pushrod has been connected to the engine for you. Even the tank is securely fitted in the fuselage with the fuel lines attached to the engine and ready to go.

The wing dowels were not glued to the fuselage and tended to move around when the wing was not attached; I fastened them in permanently with some thin CA.

A Megatech M-46 ABC ball-bearing engine and an 11x6 prop power the Nitro Air Strike. This setup provides more than enough power for this smoothly flying trainer.

Powerplant. The power supply is a Megatech M-46 ABC ball-bearing engine. An 11x6 prop and spinner are included in the kit. I balanced the prop before I installed it and the spinner on the engine. I solicited the help of my grandson to hold the plane while I ran a few tanks of fuel through the engine, keeping it slightly rich to prevent it from running lean. I made the throttle trim tab and the engine kill switch, and then I tested my engine settings by stopping and starting the engine a number of times. When I had finished all of my testing, my grandson and I could hardly wait to test-fly the plane.

ALSO AVAILABLE ...



Already have the radio and engine? Try the Nitro Air Strike ARF version for just $129. All you have to do is drop in the engine and radio gear. The ARF version uses the same seven-wing-nuts assembly to attach the wing halves, tail surfaces and landing gear. The ARF comes with all the radio pushrods, fuel tank and motor mount installed. You won't believe how fast you can get this plane into the air.

Do you live near a lake? Try out the bolt-on floats. They're attached using the same bolts as are already on the fuselage for the landing gear and have the linkage to hook up a steerable water rudder. The floats are made out of ABS plastic and have decals to match the color design of the plane. They cost less than $100.

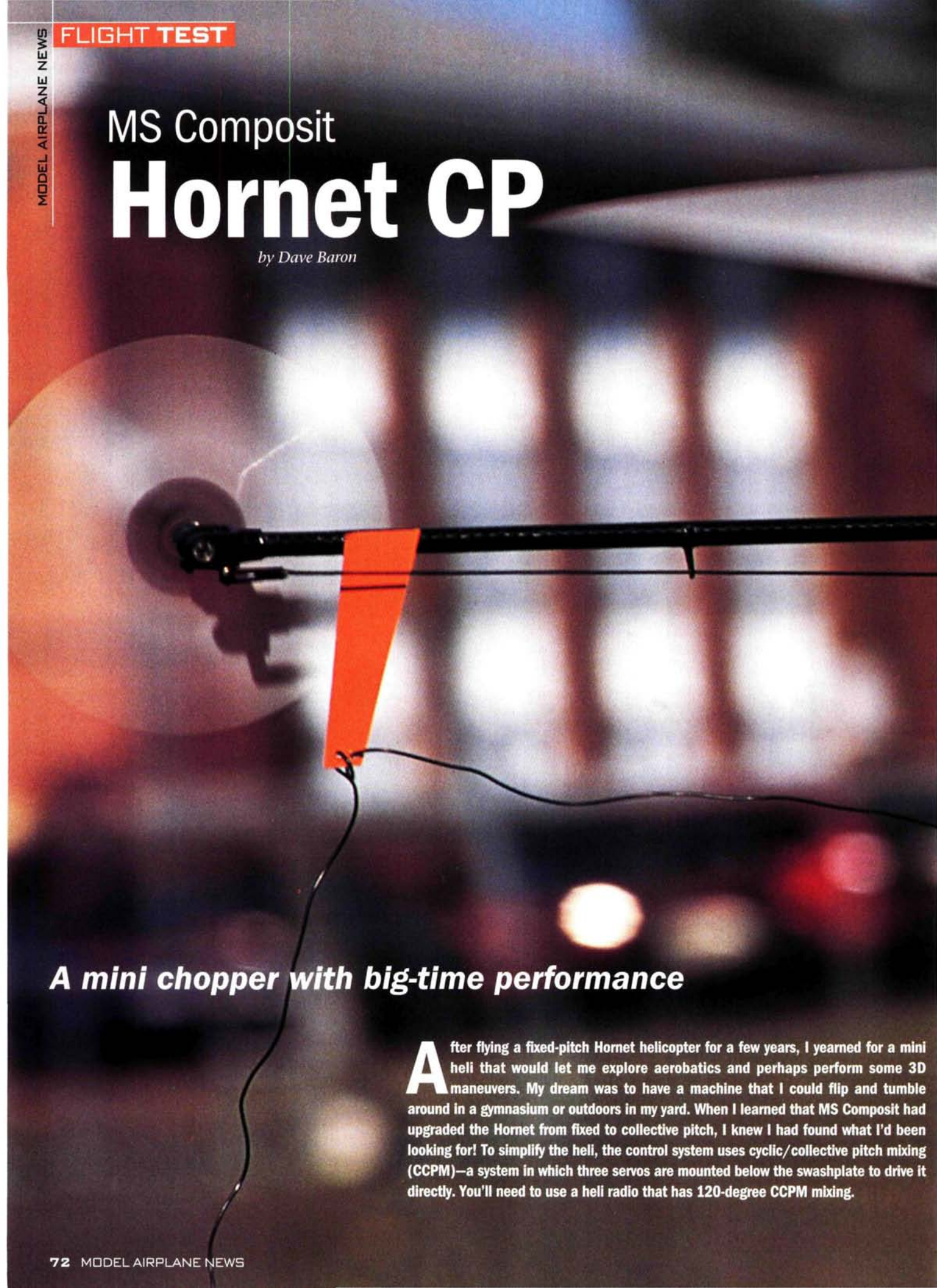
CONCLUSION

This is Megatech's first entry into the RTF, nitro-powered-aircraft market, and it has produced a good-looking, great flying trainer for inexperienced pilots. If you are looking for a trainer plane that you can get into the air quickly, with minimal building time, this is your plane. The Nitro Air Strike has stable flying characteristics and an ample power supply, and these will take you from beginning flights all the way to advanced aerobatics. Megatech has done all the work; all you have to do is go out and enjoy the sky. ✈

Airtronics (714) 978-1895; airtronics.net.
Megatech (210) 262-8500; megatech.com.
Performance Plus; a division of West Coast Fuels (909) 899-4856.

MS Composit Hornet CP

by Dave Baron



A mini chopper with big-time performance

After flying a fixed-pitch Hornet helicopter for a few years, I yearned for a mini heli that would let me explore aerobatics and perhaps perform some 3D maneuvers. My dream was to have a machine that I could flip and tumble around in a gymnasium or outdoors in my yard. When I learned that MS Composit had upgraded the Hornet from fixed to collective pitch, I knew I had found what I'd been looking for! To simplify the heli, the control system uses cyclic/collective pitch mixing (CCPM)—a system in which three servos are mounted below the swashplate to drive it directly. You'll need to use a heli radio that has 120-degree CCPM mixing.

SPECIFICATIONS

MODEL: Hornet CP

TYPE: mini electric helicopter

MANUFACTURER: MS Composit

DISTRIBUTORS: Avilus and Hobby Lobby

MAIN ROTOR DIAMETER: 19.29 in.

LENGTH: 24 in.

WEIGHT: 11.5 oz.

RADIO USED: Hitec Eclipse, Hitec Electron 6 receiver, 4 Hitec HS-55 microservos and MS-005 5A ESC

BATTERY USED: 7-cell, 720mAh NiMH

FLIGHT DURATION: 7 to 9 min.

PRICE: $159

FEATURES: parts packed as subassemblies; good instruction manual with exploded diagrams; website support; nicely molded parts.

COMMENTS: the MS Composit Hornet CP is a fun little heli that performs well indoors and out. Although there are many small parts, the heli can be built quickly. The parts are of high quality and fit together well. The detailed instruction manual and website are loaded with information, and they make building the helicopter a unique experience.

HITS
- Easy to build.
- Fun to fly.
- Internet support.

MISSES
- Tail rotor requires careful attention to assemble correctly.
- Decals are difficult to apply around curves.

FIRST IMPRESSIONS

When I opened the box, I saw that all of the parts were sealed in numbered plastic bags by subassemblies. The kit also includes a detailed assembly manual, a Speed 300 6V motor, colorful decals and a canopy that's molded in halves. The parts count is slightly higher than that of the fixed-pitch version because more parts are required for the collective-pitch mechanism. The kit is available with either a standard canopy or the more scale-like Schweizer 300 canopy; mine had the Schweizer. The instruction manual is well written and contains numerous exploded diagrams and drawings. MS Composit's website provides numerous tips and detailed pictures that clarify any questions you might have. This is the first time I've seen this type of support, and it's very helpful. I highly recommend reviewing the website before you begin assembly.

ELECTRONICS REQUIRED

To get the Hornet airborne, you'll need four microservos, a micro piezo gyro, a 7- or 8-cell, 720mAh NiMH battery and a 5A electronic speed control (ESC) with battery eliminator circuitry (BEC). As I've mentioned, you'll also need a heli radio with CCPM mixing. Here are some things to consider when choosing your equipment.

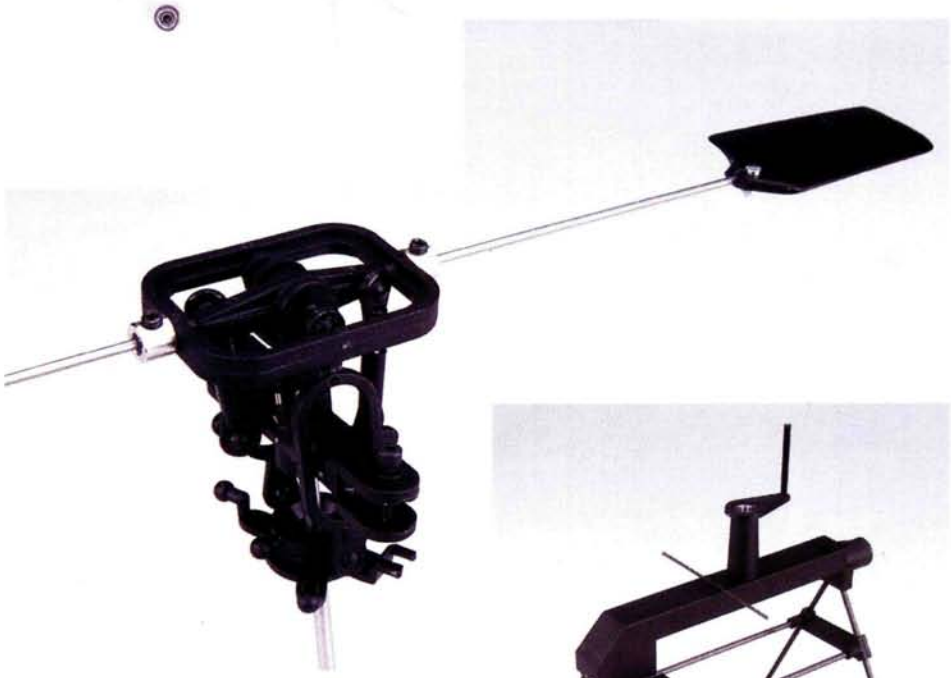
First is the ESC. Make sure that it can handle the loads imposed on it by the motor. When you use full collective, this means full power at the motor and lots of current draw. Also be sure that it can handle the battery sizes recommended. If your ESC has an adjustable low-voltage cutoff and you can't bypass it, consider using a different ESC. Nothing is more shocking than practicing unplanned autorotations!

Next is the BEC; it needs to be able to handle the four servos that are constantly working. Be sure to select servos that do not exceed the capacity of the BEC circuit.

CONSTRUCTION

The heli builds smoothly, and assembly requires only a few hand tools and thin CA. The ball links fit the balls better than any I have ever encountered; on many other helis, I have spent countless hours precisely fitting ball links to make them drag free. I'm glad this wasn't an issue with the Hornet.

Assembly is broken down into nine steps, and the exploded drawings can be removed from the manual for easy reference. I also recommend that you use a pin or a needle to precisely apply the CA. You don't want it to run where it doesn't belong.



Left: the revised tail rotor includes an updated slider assembly that's supported by two ball bearings. It eliminates slop and greatly improves the tail rotor's performance.

Below: the main rotor is easy to assemble. The blade grips and see-saw lever ride on ball bearings for smooth and precise operation.

Bottom: the main-frame assembly is very sturdy yet very light. The main shaft is supported by two ball bearings.

Main frame. Begin with the main-frame assembly—the backbone of the heli. The parts that make up the frame are molded of a tough plastic and carbon fiber; assembly is quick, and the parts fit together very well. Just be sure to use the CA sparingly; a drop goes a long way.

Tail-rotor assembly. Many small parts are involved here, so take your time, and make sure that the parts have been assembled correctly before you apply any glue. The tail rotor is where I encountered the most problems—not so much with building it, but with its performance during the flight tests. I thought the tail rotor was sticky when I first flew the heli; the heli would continue to yaw in the direction of the last control input. I was perplexed, so I disassembled and reassembled the tail-rotor assembly a few times and rechecked the pushrod and linkages. The problem persisted, however, so I decided to call the distributor, Avilus of Toronto, Canada. I spoke with Phil Anderson, who provided a lot of support to help find the cure. His first suggestion was to go to the CP upgrade pack, find the improved pitch slider and install it. The slider is a bearing with a housing around it that transfers the tail pushrod motion from the tail bellcrank to the blade grips of the tail rotor. Part of the problem is that the tail-rotor output shaft that the slider rides on is a carbon rod, and not all fine carbon rod is perfectly round. This causes the slider to drag and contributes to the sticking problem.

I installed the new tail slider, and control of the tail improved, but it still hunted enough to confuse the gyro. I noticed that the slider assembly didn't fit in its housing very well. It is melted into place with a soldering-iron tip; both the original slider assembly and the upgraded slider that came with the CP package had slop

I initially flew the Hornet in my workshop, and this is where I first encountered the sticking tail rotor. When I got the tail rotor working properly, I hovered through several battery charges before I moved outside to explore its capabilities.

GENERAL FLYING

Outdoors, I set up the heli and advanced the throttle to spool up the rotor; before I knew it, the little heli was in a stable hover. I quickly noticed that the Hornet had a "big" helicopter feel to it, unlike other mini helis I have flown in the past. The wind was blowing at a steady 10mph with gusts up to 17mph, and the heli was very solid. "Amazing" is the word that comes to mind to describe its stability. Forward flight was easy, and the model displayed good handling characteristics. I flew several circuits and figure-8s and was impressed by the model's qualities. It didn't have any pitching tendencies.

The Hornet is capable of aerobatics and is limited only by the pilot's skill. The pitch and roll rates are quick and comfortable. The tail rotor is very solid, but it could use more authority. Longer tail blades or different gearing would easily cure this. I really like that I can just step outside without any of the support equipment required for a glow-powered heli yet have the same level of performance.

between the housing and the bearing.

I have since installed another revised slider from MS Composit that consists of a two-piece brass sleeve that passes through the slider and rides on the tail-output shaft. The sleeves are tightened until the slop is gone, and it acts as its own bushing when it's spinning. This new slider has solved all of my problems with the tail; it's now powerful and solid, with no hunting or centering problems.

Rotor head/flybar assembly. The design of the head is very similar to those used in larger glow-powered helis, and MS Composit uses ball bearings to support the blade grips and the flybar assembly for smooth operation. Like the tail rotor, the main rotor head must be assembled from many small parts. It went together without any problems, but be aware of a few things. The main shaft has two holes drilled through it; the hole nearest the end of the shaft goes toward the bottom. Three O-rings are installed in the underside of the hub, and they provide some damping to the head. For easier installation, they should be lubricated with a silicone-based lube. When you install the flybar, make sure that it's centered in its carrier. Also, don't overtighten the setscrews that secure it; you'll end up bending the flybar. Last, balance the assembly before you install it on the main shaft.

Here's the Hornet in action. Three servos work in unison to drive the swashplate for collective and cyclic control. Note the boom-mounted tail-rotor servo.

Final assembly. Now it's time to put all the subassemblies together and make the Hornet look like a helicopter. Slide the main shaft with the rotor head through the frame assembly and then secure the main drive gear with a small metal pin. Make sure that the main shaft has no vertical play. Insert the tail boom in the frame and adjust the gear mesh. The gears must rotate freely without binding or excess slop. Next, I installed the motor after I soldered the three included capacitors to it. Per the instructions, I installed the servos, linkages, gyro, receiver and ESC.

The canopy is the last item that requires attention. It's vacuum-formed in halves and needs to be trimmed and glued together. I trimmed the halves with scissors because they're easy to control. I then taped the canopy halves together and trial-fit the canopy to the frame of the heli. Next, I glued the halves together with RC-56 canopy glue because it dries clear and cleans up with water. I have never had good results with CA. After the glue had dried, I painted the canopy from the inside and attached the decals to the outside. MS Composit provides a decal sheet with a great variety of colors and styles to decorate the canopy. The decals, however, are difficult to apply on some of the curves; they won't stay attached.

Following the instructions, I did the final setup and adjustments as needed and was ready to give the Hornet a whirl.

SUMMARY

I had a lot of fun assembling the Hornet. The kit is well engineered and can be built quickly. The instructions provide a lot of detail, and when combined with the photos and additional information on the MS Composit website, very little is left to question. The best part, though, is the way the Hornet flies. The cyclic and collective response is rock solid and equals many of the glow-powered helicopters that I have flown! If you're looking for an electric heli that can be flown either indoors or out, the MS Composit Hornet CP is hard to beat. ✈

***Hitec RCD Inc.** (858) 748-6948; hitecrcd.com.*
***MS Composit;** distributed by Avilus Micro Aviation Ltd.; avilus@rogers.com; and by Hobby Lobby (615) 373-1444; hobby-lobby.com.*

Freestyle aerobatic techniques

The Roller Coaster

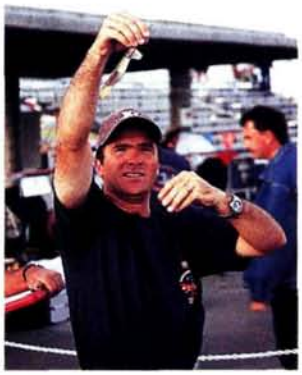
by Quique Somenzini

Editor's note: it's no wonder that Quique Somenzini's name is well-known in aerobatics circles; he's a four-time Tournament of Champions (TOC) winner, has won the F3A U.S. National Championships twice, and at the 1994 TOC, he introduced RC to 3D maneuvers, which he then called, "flying beyond the stall." Quique notes that since he started flying RC in 1976 at the age of 9, he has always challenged himself to fly the best he can, and competing has helped push him to excel. He writes that flying "... has been—and still is!—a very enjoyable challenge, and in RC aerobatics, there are always new things to do, try and learn." Model Airplane News is pleased to present this series of articles by Quique on freestyle aerobatics.

The 1988 Tournament of Champions was the first contest in the world to include freestyle aerobatics. In 1990, contestants added music to enhance their freestyle performances. Today, pilots also add ribbons, smoke, fireworks and banners to their freestyle routines, but in my opinion, nothing enhances a performance more than precision flying to music.

To me, the challenge of freestyle is to combine Aresti precision and 3D aerobatic maneuvers that are coordinated to music. Flying to the rhythm of the music is demanding on both the airplane and the pilot's skill, and it also requires the ability to fly a wide range of maneuvers. It's easy to describe but much more difficult to do with a transmitter stick! In this series of articles, I'll share my personal experiences as well as my thoughts on how to perform freestyle aerobatics, which maneuvers you should know, radio setup, flying techniques and more.

The author practices a maneuver during the most recent TOC.



THE MANEUVERS

Even though a freestyle program is only 4 minutes long (or 2, then 3 and 4 minutes long in the FAI Artistic Aerobatic category), you need to master a great variety of maneuvers to have a winning freestyle program. These maneuvers come from the Aresti catalog (also known as "Precision") and 3D aerobatics.

I flew three freestyle programs for TOC 2002; the following is a brief description of the maneuvers for just one of those programs (which was choreographed to four different songs!):

1. 180-degree rolling turn with ¾ rollout and ½ roll in to knife-edge
2. Low knife-edge pass
3. 135-degree climb with opposite rolls
4. Upright flat spins
5. Terminator
6. Torque roll
7. 270-degree turn to the beat of the music, knife-edge to knife-edge
8. Knife-edge 180-degree turn
9. Goo-Goo knife-edge
10. Vertical up line with point rolls to fishtail
11. Knife-edge spins to flat recovery
12. 4-point roll inverted to inverted
13. Shark tooth, full roll up followed by 4-point roll on the 45 leg
14. ½ rolling Cuban-8
15. Roller Coaster
16. Rolling zero-G parabola
17. 360-degree rolling circle, combinations of point rolls and rolls to the beats of the music
18. ½ rolling loop
19. Pendulum
20. Terminator to cobra

The author's 120-inch-span Yak 54 has the generous aileron and rudder surfaces needed for extreme aerobatics.

Many of these—especially the Aresti maneuvers—may be familiar to you. Some are known 3D maneuvers, but others—such as the Terminator, Goo-Goo knife-edge, Roller Coaster and Pendulum— have been named by other pilots or by me.

In this series, I would like to go through some of the 3D maneuvers in this program, especially the new ones, and review the older ones and some Aresti maneuvers.

THE ROLLER COASTER

My friend Wayne Ulery helped me to name this maneuver. I think the name fits very well, because the plane looks as though it's on a roller coaster in the air, and it's a fun maneuver to do, too! To do the Roller Coaster, start by flying downwind, straight and level at about ⅓ of your model's top speed. Pull up the elevator to full deflection. The model will execute a big pitch change: its nose will go up past vertical to about 130 degrees, and at the same time, the model will slide backward so its tail is in front of its nose. Immediately add full down-elevator, and the airplane will again execute a big pitch change; its nose will push down and past vertical again (nose down), and the tail will look as though it is jumping and pivoting on the model's nose and past vertical (nose up) to get to an almost flat inverted position. Then, from that position, pull the elevator full up again to rotate, and pivot around the wing's main axis (CG) to move the nose back to the vertical up position. The model will rotate nearly 270 degrees around its main wing axis. Then push it to level, and recover upright.

THE TECHNIQUE

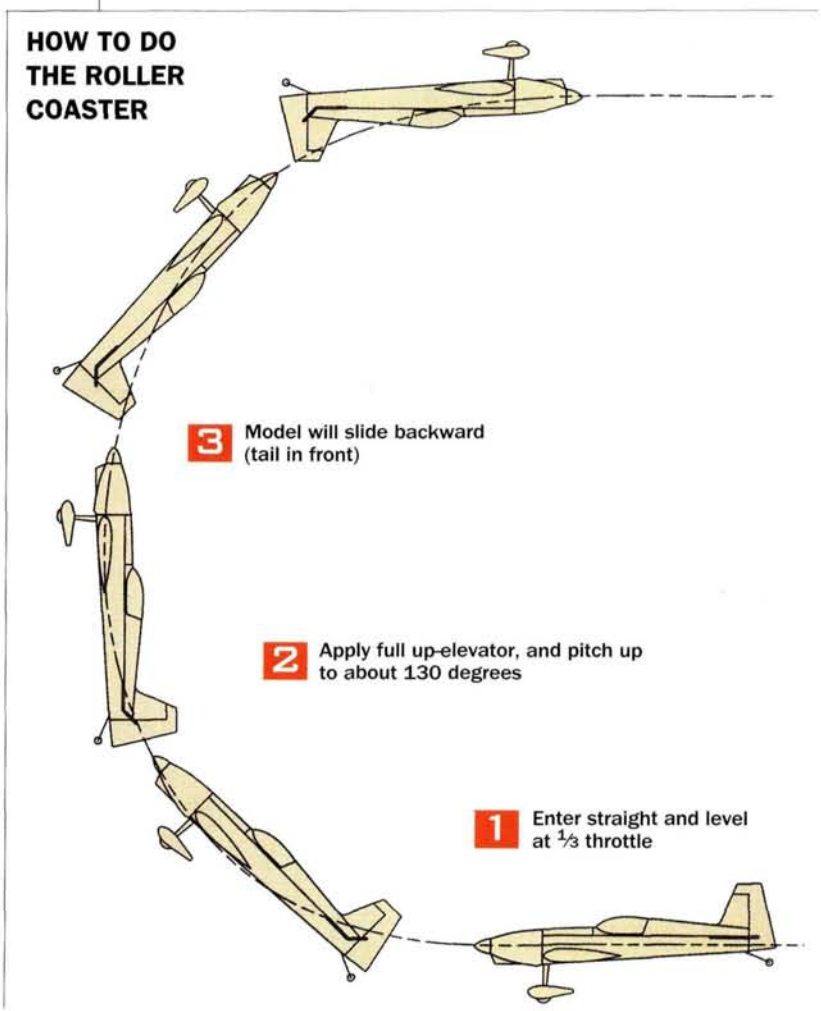
Keep in mind that the airplane you use to fly the Roller Coaster should have generous aileron and rudder surfaces. The keys to this maneuver are to first come downwind at the right airspeed (about ⅓ of your model's top speed) and then play with the elevator and throttle at the right time. The combination of elevator and throttle makes this maneuver possible.

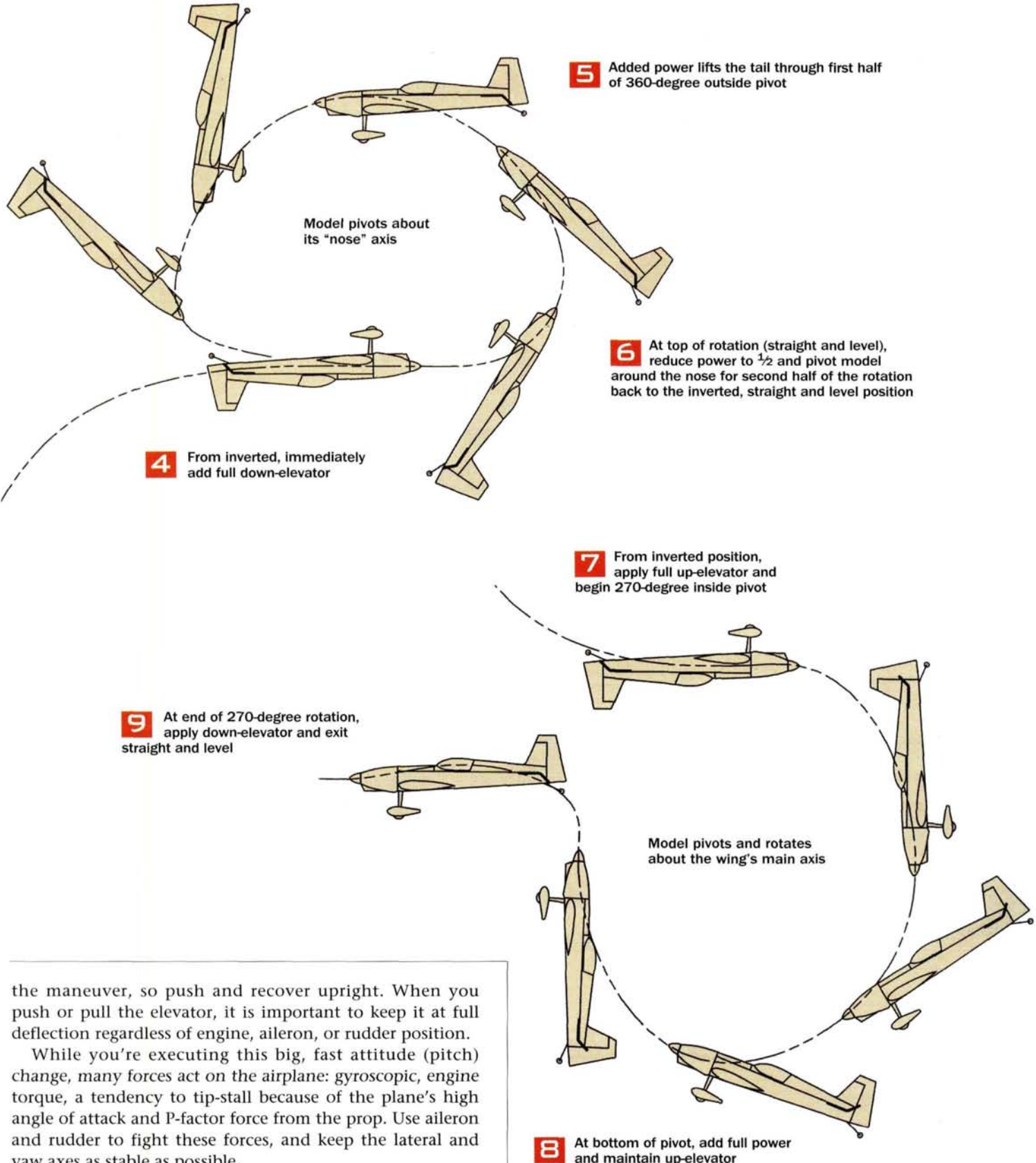
The elevator is very involved in this maneuver, and your model's elevator should be at least 40 percent of the total stabilizer area. You also need a lot of deflection—at least 40 degrees up and down. Without this area and deflection, you won't be able to properly execute the maneuver.

Throttle use is also very important; you must manage it well to generate the right forces at the right time to help the airplane go into such deep elevator turns. When the plane is coming straight and level and you pull the elevator for the first time, simultaneously reduce throttle to idle to allow the airplane to slide and lift its nose without gaining much altitude. For a moment, the model will look as though it is flying backward (especially if the wind is strong). Then, when that slide is finished and the airplane is nose-up and past vertical, the model will look for a moment as though it is frozen in the air. That's when you should push the elevator to full down and add ½ to full power, depending on how far the airplane slid past vertical.

When you push the elevator and add power, all that propwash will blow over the elevator and make the airplane (which is nearly static in the air) lift its tail. If you correctly coordinate the elevator, throttle and airspeed, the tail should lift and pivot on the airplane's nose to pass vertical and return to an almost flat inverted position, i.e., it will rotate almost 360 degrees. From that position, reduce the power for just a moment to avoid any forward airspeed, and pull full up-elevator to make the airplane rotate around its CG and move from that almost inverted flat position so that its nose is nearly vertical.

The airplane will rotate about 270 degrees and lose some altitude. When the airplane is nose down and its nose is about to rise, add all the power the airplane has to help make the elevator control more effective. This is the end of





the maneuver, so push and recover upright. When you push or pull the elevator, it is important to keep it at full deflection regardless of engine, aileron, or rudder position.

While you're executing this big, fast attitude (pitch) change, many forces act on the airplane: gyroscopic, engine torque, a tendency to tip-stall because of the plane's high angle of attack and P-factor force from the prop. Use aileron and rudder to fight these forces, and keep the lateral and yaw axes as stable as possible.

FINAL COMMENTS

In future articles, I'll continue to discuss the Roller Coaster maneuver as well as other 3D and Aresti maneuvers and freestyle aerobatics.

It's important to remember that no matter your skill level, to be a good, refined pilot and have a winning freestyle program, you must be able to fly a risky, surprising mixture of 3D and Aresti maneuvers that are executed smoothly and precisely. No matter what kind of maneuver you fly, you always need to show that you're in control of the airplane.

My friends, until next time!

PRODUCT REVIEW

Hitec NEON

An easy-to-upgrade system you can grow with.

by Gerry Yarrish

Products that can be customized and upgraded are much appreciated by consumers. From automobiles and motorcycles to stereo systems and personal computers, the ability to choose the features you want means you'll get the best value for your money. The folks at Hitec understand this and have applied this "exactly-what-you-want" principle to their newest radio system: the Neon-SS. Let's take a closer look.

PHOTOS BY PETE HALL

The new Neon-SS from Hitec is a 3-channel system that can be upgraded to four channels and customized with several additional features.

UPGRADING EASE

The days of soldering electronic components into your radio are long gone. All of Hitec's Neon upgrades are simple plug 'n' plays! All you have to do is open up the radio case, install the feature you want and plug its lead into the appropriate location. That's it! It couldn't be simpler.

The four upgrade packages are:

- **Fourth channel (no. 54301).** This is a 3-position switch that, when installed, is located on the transmitter's top right-hand corner. The center position is neutral; moving the switch to either of its extreme positions causes the servo to move all the way in either direction. This is good for 3-position flap control or any other function you might want that does not require proportional servo control.
- **ATV (no. 54302).** ATV (or "Travel Volume") allows you to increase or decrease the servos' total travel range. The ATV upgrade controls channels 1, 2 and 3 (rudder, elevator and throttle). When installed, these adjustments are located just below the radio's power switch.
- **Trainer function (no. 54303).** Consisting of a switch and a connection port, this upgrade allows a student's and instructor's radios to be connected by a cable to share control of the student's model. When the instructor holds the switch in the on position, control is given to the student's radio. Should the student lose control of his model, the instructor merely lets go of the trainer switch, and control is returned to his radio. The switch is found at the top left corner of the radio; the port is on the lower, right rear corner.
- **Dual rate (no. 54304.)** Used on channels 1 and 2, dual rates (also referred to as high or low rates) allow you to switch between two servo-travel settings. You can adjust each rate independently, and this provides a quick and easy way to change rudder and elevator control sensitivity. Note: the ATV upgrade must be installed before you can install the dual-rate function.

The completely upgraded Neon is a multifunctional, 4-channel system that you can grow into a little at a time.

SPECIFICATIONS

TRANSMITTER: Neon-SS

TYPE: single-stick, 3-channel upgradable

MODULATION: FM

FREQUENCY RANGE: 72Mhz

OPERATING VOLTAGE: 9.6

SIZE: 6.5x6.25x2.375 in.

WEIGHT: 1 lb., 4.73 oz.

RECEIVER: Electron 6

TYPE: micro 6-channel dual conversion

MODULATION: FM

RANGE: 1 mile (1.6km)

OPERATING VOLTAGE: 4.8 to 6

CURRENT DRAIN: 19mA ± 3mA

SIZE: 1.8x0.9x0.6 in.

WEIGHT: 0.6 oz. (w/case), 0.46 oz. (w/out case)

SERVOS: HS-81 micro

SPEED: 0.11 sec. @ 4.8V/0.10 sec. @ 6 volts

TORQUE: 36 oz- in. @ 4.8V/41 oz.-in. @ 6 volts

SIZE: 1.2x0.47x1.2 in.

WEIGHT: 0.28 oz.

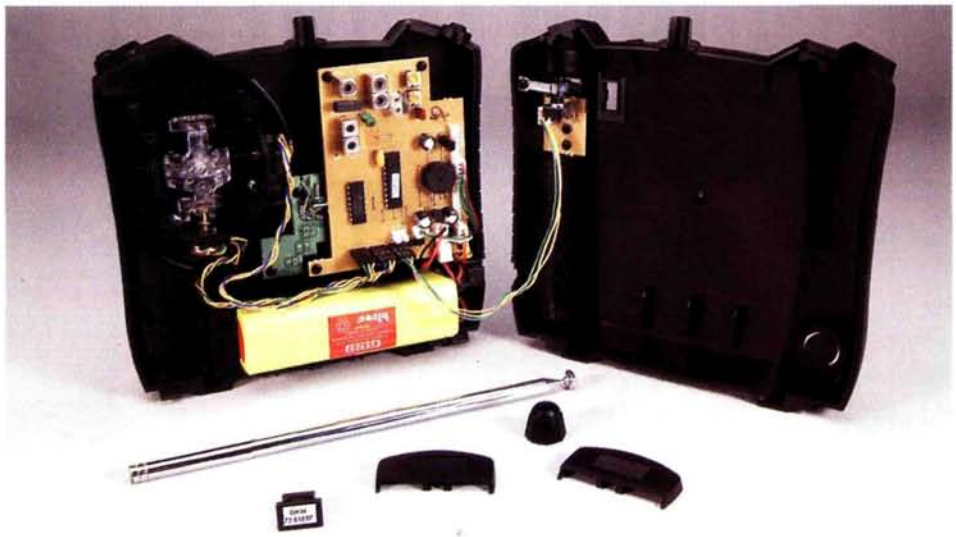
PRICE: $95 (Deluxe), $125 (Standard)

FEATURES: the new Hitec Neon-SS is a single-stick, 3-channel FM radio system. It comes with two servos and a choice of airborne packs. The radio comes with built-in trim adjustments for elevator and rudder and V-tail/elevon mixing. The new ergonomically designed transmitter has an easy-to-use, proportional third channel slide switch on the back and includes servo-reversing on channels 1 and 2. The Deluxe version includes a Ni-Cd battery pack and charger.

COMMENTS: what sets the Neon-SS apart from the rest is that it's available with several upgrades that can be purchased separately and added when needed. You can easily add a switched fourth channel, ATV for channels 1, 2 and 3, dual rates for channels 1 and 2 and a trainer switch and connection port.

HITS
- Great value.
- Upgradable.
- Choice of airborne packs and servos.

MISSES
- What's not to like?



The case can be opened without removing a single screw.

In its basic format, the Neon-SS is a single-stick, 3-channel radio. The system comes with a receiver and two servos, a battery holder (for 4 AAA batteries) and switch harness, servo-mounting accessories, a frequency flag, channel numbers and an instruction manual. The standard version uses non-rechargeable alkaline dry cells (not supplied) to power the transmitter. A Ni-Cd pack and charger are included with the Deluxe version. The radio also comes with a one-year limited warranty.

TRICKED-OUT TRANSMITTER

The handheld transmitter has a single, dual-axis, adjustable-length control stick that operates channels 1 and 2 (elevator and rudder). A slide switch on the back of the case provides proportional control for channel 3 (throttle). At the base of the main control stick are two trim adjustments for elevator and rudder. Throttle has no trim feature. Also on the front of the radio are an elevon mix switch, an on/off switch and three LED battery condition indicators. On the lower right side is the charging jack for the transmitter's Ni-Cd battery pack. Five removable plugs allow future upgrades to be added without your having to drill any openings.

By eliminating all those pesky assembly screws that usually hold a radio together, Hitec has made it very easy to add the upgraded components. In their place are two easily removable slide-out lock tabs (at the lower corners) and a snap-on bezel at the base of the antenna. Simply remove these three molded plastic parts, unscrew the antenna and pop out the crystal, and the radio case halves come apart in your hands.

You have a choice of airborne packs with the Neon. Shown here: Micro 6 RX and HS-81 servos.

FLIGHT PACK PICKS

Two onboard flight packs are currently available for the Neon-SS. The Deluxe version includes an Electron 6 dual-conversion 6-channel FM receiver and two HS-81 microservos that provide about 36 to 41 oz.-in. of torque. The Micro version is equipped with an HFS-04MG 4-channel, single-conversion FM receiver and two HS-55 sub-microservos that provide 15 to 18 oz.-in. of torque. With the exception of the HS-50, which operates on 4.8 volts only, all Hitec servos can be operated within a voltage range of 4.8 and 6.

Both receivers come equipped with an appropriate crystal. The Electron 6 receiver is available with negative shift (compatible with Hitec and Futaba radios) and with positive shift (Airtronics and JR radio compatible). The HFS-04MG receiver is compatible with Hitec and Futaba radios (negative shift). The receiver battery box is smaller than usual and uses AAA batteries. This saves a good bit of weight compared with the typical AA battery box—a definite plus for those interested in lightweight backyard flyers. The complete Electron 6 flight pack with two HS-81 servos (not including batteries) weighs only 2.28 ounces.

It is refreshing to find a product that you can purchase at a reasonable price ($95) and then add to as your needs change. With Hitec's new plug-n-play Neon-SS, the price of admission and the available upgrades will ease your way into the RC hobby. ✈

Hitec RCD Inc. (858) 748-8440; hitecrcd.com.

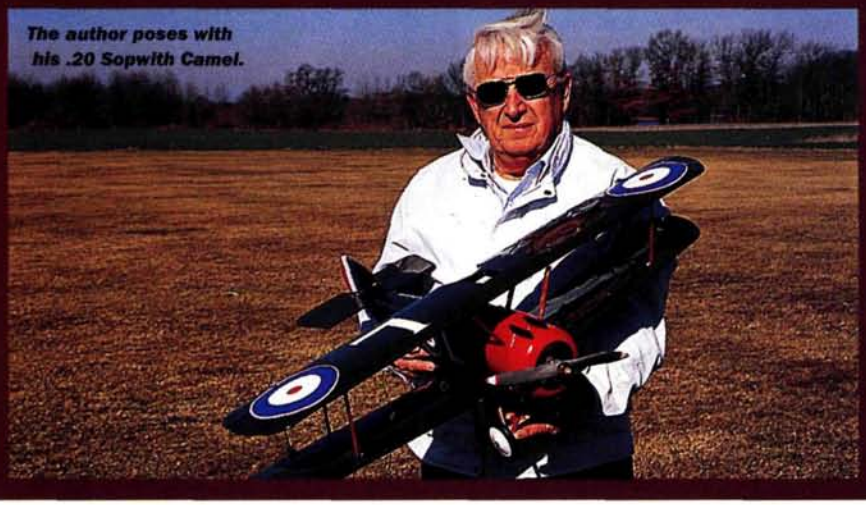
by John Tanzer

.20 SOPWITH CAMEL

A scale WW I fighter for small frontline action

I've designed and built giant-scale planes for 15 years because I love to fly the big planes. Seeing all the new electric flyers, however, has piqued my interest in smaller designs. The Sopwith Camel was one of England's best fighters during WW I, and when I saw one fly at the Old Rhinebeck Aerodrome in New York, I thought it would be a perfect candidate for a small, 4-stroke Saito engine.

The only scale changes I made were to lengthen the nose a bit and to use a flat-bottom airfoil. The rib count is scale, but I left out all of the false ribs (60 ribs are enough to make!). I tried to make the Camel look good and still keep its construction simple.



The author poses with his .20 Sopwith Camel.

SPECIFICATIONS

MODEL: Sopwith Camel

TYPE: scale WW I biplane

WINGSPAN: 38 in.

LENGTH: 25 in.

WING AREA: 485 sq. in.

WEIGHT: 45 oz.

WING LOADING: 15 oz./sq. ft.

AIRFOIL: flat bottom

ENGINE REQ'D: .15 to .20 2-stroke or .30 4-stroke

ENGINE USED: Saito .30 4-stroke

RADIO REQ'D: 4 channels (rudder, elevator, ailerons and throttle)

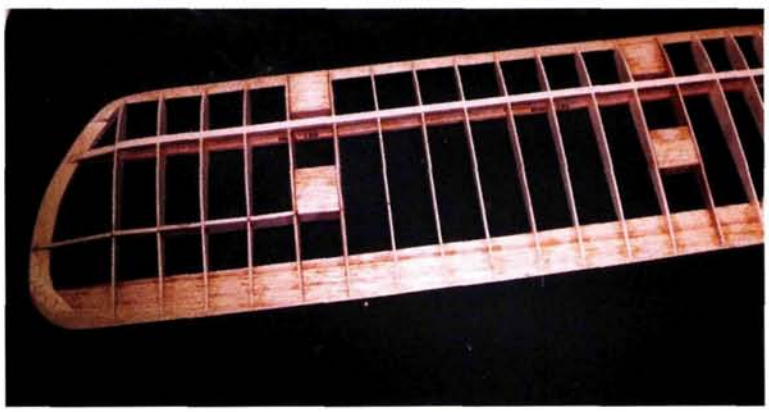
COMMENTS: the small Sopwith Camel is not difficult to build. Flight with the Saito .30 engine turning an 11x4 APC prop is very spirited. The most difficult part of flying it is landing it; if the grass is a bit tall, the axle will catch, and the plane will nose over. The Camel can be converted to electric very easily; just keep all the batteries in the cowl next to the motor. A firewall is not used; the engine is installed using a plywood plate that slides into place between the fuselage sides. With its small size, the model can remain fully assembled and be taken to the flying field in a small car.

CONSTRUCTION

First, cut out all of the wing ribs from 1/16-inch balsa sheet; I use the stack-and-cut method because I only have to cut holes for the aileron-servo extensions in the lower wing ribs. Make the lower wing center ribs out of 1/4-inch balsa and the individual vertical-grain shear webs out of 1/16-inch sheet balsa. Cut the two upper wing center cutouts out of 1/4-inch balsa (note: one is cut cross-grain), and then glue them together. The wingtip bows are each a three-layer lamination of 1/16-inch balsa sheet. I used 3M Super 77 spray adhesive to glue the layers together with the center one positioned cross-grain. After the adhesive has dried overnight, cut them to shape. The rudder, fin, stabilizer, elevator, wing saddle doublers and all the fuselage formers are also made using the three-layer balsa-lamination technique. If you're careful, you'll be able to cut all the parts out of one sheet.

To build the wings (top wing first), pin down the spruce spar over the plan, and using one or two ribs as a guide, pin down the balsa-sheet trailing edge. Start at the center and, at the same time, glue the first full rib and first shear web to the spar. Add the next rib and web and continue all the way out to both wingtips. Don't worry if your ribs don't line up with the ones on the plan; it isn't important. Keep the ribs and webs in tight contact with each other. Next, glue the center cutout piece to the trailing edge and then cut, fit and glue the two center ribs into place in the center, followed by the 1/4-inch crosspiece. Glue on the wingtips, the W-2 tip ribs and the A-1 aileron rib ends. Fill in between the ribs at the aileron hinge line with 1/16-inch balsa sheet. The ailerons are cut out after the wing has been completed. Glue in the top spar followed by the 1/4-inch-square balsa leading edge, then cut a rib to fit into the front center section. Glue in all the balsa strut-mounting blocks, and then remove the wing from the plan. Round off the leading edge, and then shape the center cutout and the wingtips. Sand the wing smooth, and then carefully cut out the ailerons. Glue 1/16-inch balsa sheet to the face of the aileron bay, and then cut the aileron's leading edge at an angle (for top hinging). Then glue the 1/16-inch balsa-sheet leading edge. You'll use MonoKote to hinge the ailerons to the finished wing.

Build the lower wing in two panels using the same method as you used for the top wing, but leave out the center W-3 ribs. After the two panels have been built, remove them from the plan. Pin the center bottom spruce spar and the trailing-edge sheeting to the plan. Install the 1/16-inch ply dihedral brace, and secure it to the top of the spar with Zap glue. Pin down the 1/8-inch ply landing-gear mount, and slide on the wing panels. Block up the tips to give 2 inches of dihedral to each wing, and then glue in the top spar. Before you install the W-3 ribs, use CA to glue some 1/4-inch strips of carbon fiber over the spar and trailing-edge joints. Do the same to the bottom joints after you've removed the wing from the plan. Glue the W-3 ribs and leading edge into place, and remove the wing from the plan. Sand and shape the wing as before, and then cut out and finish the ailerons. Glue an 1/8-inch-ply control-horn mount into each bottom aileron, then, in all four ailerons, glue in the 1/16-inch plywood slave-rod horns. Make the servo bay in each lower wing panel to suit your servos.



The finished top wing. The aileron is built as part of the wing panel and is cut away later. Note the shear webbing between the main spars.

PHOTOS BY JOHN TANZER

FUSELAGE

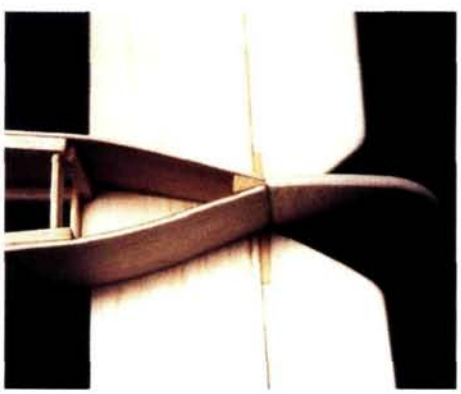
Using the pattern shown on the plan, cut out two 1/64-inch-ply fuselage doublers, and then glue them to 1/16-inch balsa. (Make a left and a right side.) Use the doublers as a guide, and cut the fuselage sides to shape. Clamp the two sides together, and sand their edges to make them identical. On the inner surfaces, back to station F-6, glue on the longerons and uprights followed by the wing-saddle doublers. Pin the balsa crosspieces to the top view back to F-4, then, with the sides placed upside-down, pin and glue them to the crosspieces. Glue the ply wing-dowel mount and wing-bolt plate into place. Pull the rear fuselage ends together, and glue in the rest of the crosspieces. Make a balsa wedge to join the ends of the fuselage sides together. Cut the two pieces of 3/16-inch balsa filler to shape, and glue them into the top and bottom of the fuselage to form the stabilizer saddle. Fit the lower wing to the saddle (with the fuselage still pinned to the workbench), and check that the wing is level; measure from the bench up to the wingtips. Drill a 3/16-inch hole through the wing-dowel plate and into the wing leading edge. Remove the wing, glue the 3/16-inch dowel into the leading edge, and glue the ply wing-bolt plate to the trailing edge. Reinstall the wing and check the alignment. Drill and tap the wing hold-down bolt hole for a 10-32 bolt. Harden the threads with thin CA, and remove the fuselage from the bench.

Small lengths of yellow inner Nyrod are glued into the mounting blocks to act as anchors for the wing-attachment screw.

Here, the cabane wire is covered with balsa. The balsa will be shaped to an airfoil when completed. Note the attachment tabs for the wing screws.

CABANE & WING STRUTS

Using the front and side views as a guide, bend the cabane struts to shape from 3/32-inch welding rod. Solder tin or brass sheet-metal screw plates to the top of the cabane, and then drill 3/32-inch holes into the top fuselage longerons to accept the wire cabanes. Temporarily clamp the cabane wires to the fuselage sides, and then, with the top wing placed upside-down on the workbench, lay the fuselage on top of the strut-mounting blocks. Align the wing with the fuselage, and mark the locations of the screw holes. Remove the fuselage, and drill 1/8-inch holes in the wing blocks. Insert 1/2-inch-long pieces of yellow inner Nyrod in the holes to act as screw anchors. Glue the anchors into place with CA, and then attach the wing to the



The aft ends of the fuselage sides should be joined with this wedge-shape balsa filler.

FLIGHT PERFORMANCE

At the field, I ran a tank of fuel (2 ounces) through the Saito to see how long it would run, and I set the high- and low-end needles. The engine runs for about 6 minutes.

TAKEOFF AND LANDING

The taxi out and turn into the wind were good; the steerable tailskid helps a lot. I gave it the throttle and let the tail come up, and the Camel dumped over on its little red nose. On the next try, I held the tail down, and the little Camel jumped into the air. I quickly leveled it out. The controls are very effective. For smooth scale turns, I coupled the rudder to the ailerons a bit. On the landing approach, I cut the throttle to idle, and with its 15-ounce wing loading, it glides nicely. A low-pitch prop and a low idle work well. A 3-point landing is better than a wheel landing because the model likes to nose over unless the field is very smooth. Nose-over arrivals don't do any damage, though, because it's light.

GENERAL FLIGHT CHARACTERISTICS

For such a small and short-coupled plane, the Camel flies very well and can handle some wind without any trouble. It is best to take off and land into the wind. With aileron differential and coordinated rudder, turns are very scale. The best part is a nice slow and low flyby with the little Saito putting along.

AEROBATICS

The little Camel can do all of the scale WW I-type maneuvers and then some: rolls, loops, wingovers, Immelmanns, chandelles and spins. The not-so-scale maneuvers, such as inverted flight, knife-edge and a rolling circle, are also possible. Slow flight is great; the control surfaces work right down to the stall.

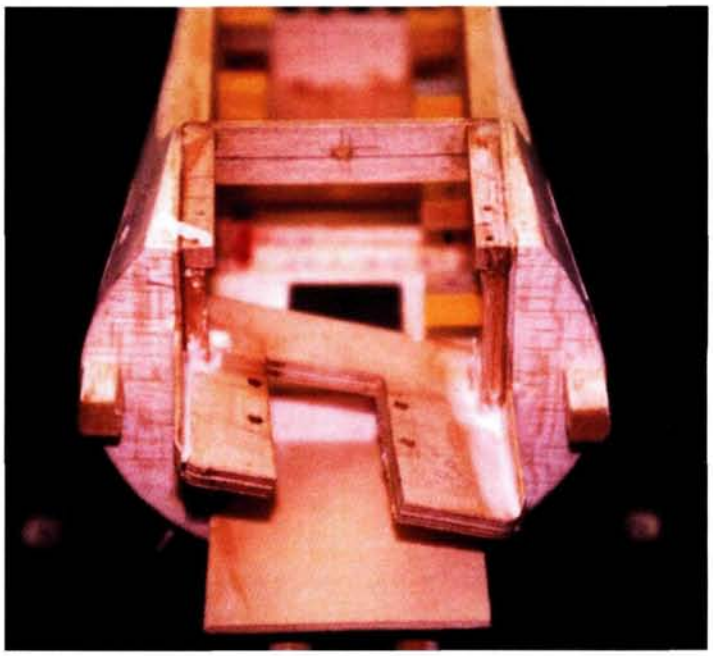
cabanes with no. 2 sheet-metal screws.

Install the lower wing, and check the incidence. Block up the model so the lower wing has 2 degrees of positive incidence, and then position the cabanes so the top wing has 3 degrees of positive incidence. Make four grooved blocks to cover the lower cabane wire ends as shown, and then epoxy the blocks into place.

To maintain the spacing between the wings at the interplane strut locations, clamp a stick to the upper and lower ribs. Make eight tin or brass sheet-metal angle brackets, and then drill and screw them to the attachment blocks. Make the struts from ⅛x⅜-inch spruce, and cut a slit in their ends to slide over the brackets. Tack-glue them to the brackets, and then remove the struts (one at a time) and mark their locations so they can be installed in the same place each time. Drive a T-pin through the strut and bracket, soak the joint with CA, trim the bracket and sand the strut to shape.

TAIL SURFACES

Cut the stabilizer, elevators, fin and rudder to shape, and dry-fit them together with CA hinges. With the wings still attached, align and glue the stab and fin to the fuselage. Make the steerable tailskid, and then epoxy it into a slot cut into



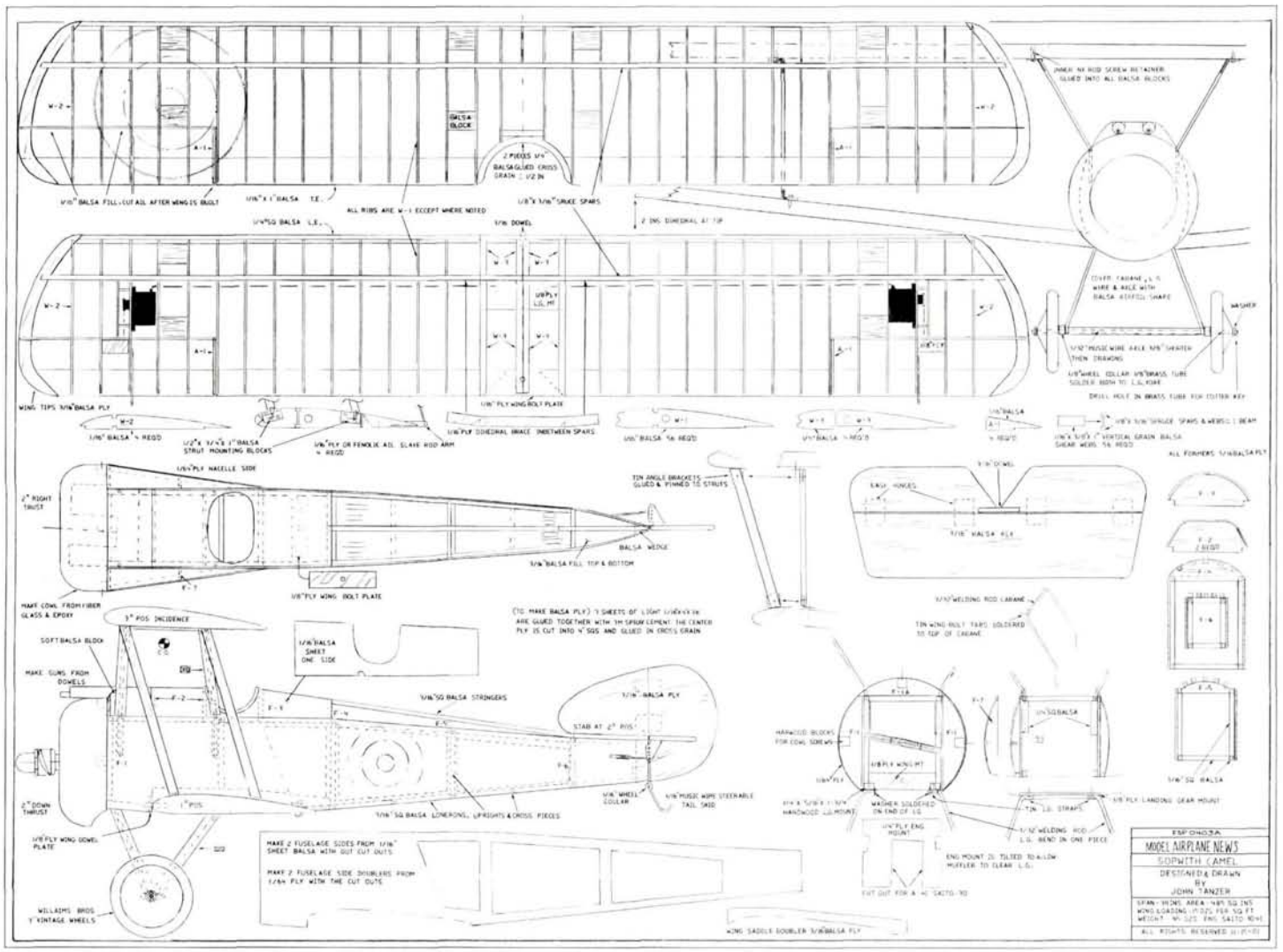
The engine-mounting plate is made of ¼-inch plywood. Note the angle at which it's installed. This positions the engine so the muffler clears the landing gear.

FSP0403

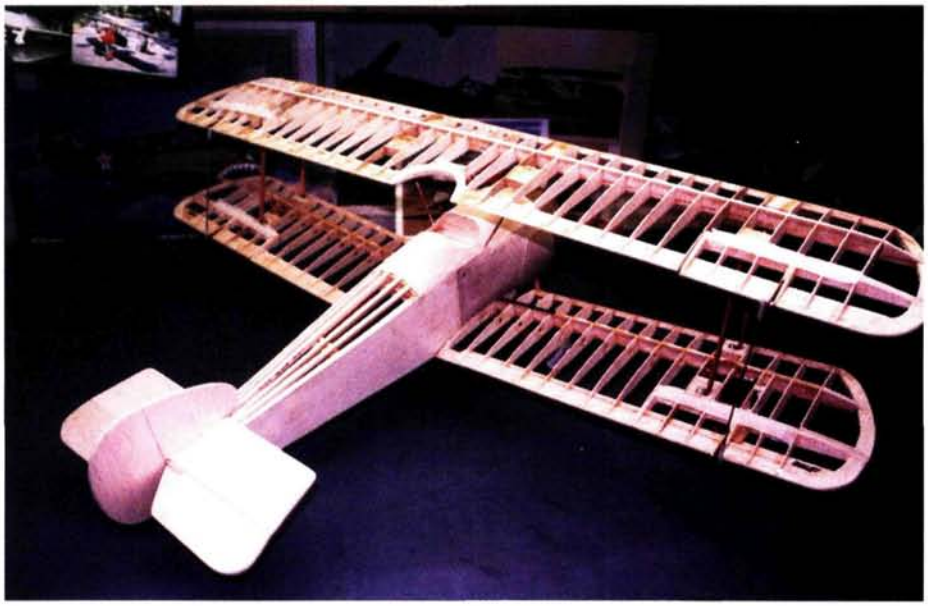
Sopwith Camel

Designed by John Tanzer, this small Sopwith Camel is not difficult to build. It uses traditional balsa and plywood construction, and several balsa parts are made from three-layer laminations. Flight with the Saito .30 engine turning an 11x4 APC prop is very spirited. The Camel can be converted to electric very easily; just keep all the batteries in the cowl next to the motor.

WS: 38 in.; L: 25 in.; engine: .30 4-stroke; 1 sheet; LD 2. $14.95



To order the full-size plan, turn to "RC Store.com" on page 156.



The Camel all framed up with everything installed and ready for covering.

the lower end of the fuselage. Remove the wings, and finish the fuselage by adding all the formers, top sheeting, stringers and a soft balsa block to shape the front. Cover the nacelle sides with 1/64-inch ply.

ENGINE AND COWL

Form the cowl over a foam plug covered with heat-shrunk plastic wrap, but make the cowl before you install the engine so you can properly center the prop shaft. Apply three layers of 4-ounce fiberglass cloth, and pull a section of old nylon stocking over the cloth to fit it tightly to the plug. Apply thinned epoxy resin to saturate the glass cloth. After the resin has cured, sand and cut the cowl to size. Glue three mounting blocks to the front of the fuselage, and then attach the cowl with no. 2 sheet-metal screws. Make a 1/4-inch-ply engine mount as shown on the plan, and then attach the engine to the plate. To allow the muffler to clear the landing gear, fit the plate into place so the engine is inverted and at a slight angle. Install the cowl, and move the mounting plate around until the prop shaft is centered and has 2 degrees down and 2 degrees of right thrust. When everything has been positioned correctly, tack-glue the mount into place, remove the cowl, mix a batch of epoxy, micro balloons and resin, and permanently glue the mounting plate into place.

There isn't much room, but everything fits in the fuselage. A 2-ounce tank fits just below the receiver and provides 6 minutes of flight time.

LANDING GEAR

Glue two hardwood blocks on each side of the engine to attach the landing gear. Bend the gear out of one piece of 3/32-inch welding rod. Solder washers to the open ends of the gear. With the lower wing in place, attach the gear with sheet-tin straps and no. 2 sheet-metal screws. Make the 3/32-inch music-wire axle 3/8 inch shorter than is shown on the plan. Slip a brass tube and wheel collar over each end of the axle wire so the axle tubes are 3/16-inch past the wire ends. Tighten the wheel collars to hold the tubes in place, and then solder the axle, wheel collar and brass tube to the landing gear. To retain the wheels, cross-drill the tube ends to accept a cotter pin and washer. Cover the landing gear and cabane wire with balsa, and sand them to an airfoil shape.

FINISHING

Use maple stain and varnish to finish the cabanes, landing gear and interplane struts. Install the servos and a small receiver, and let the antenna trail out of the back. If you install all of the radio gear as far forward as possible, you may not need to add any weight to the nose. I use five GWS BP-107 microservos (two for the ailerons, one for the elevator and one each for the rudder and throttle). I installed an 800mAh battery above the engine within the cowl, and I used a Harry Higley brass prop nut on the engine.

I covered the model with olive green and buff MonoKote, and I painted the cowl red. The roundels, tail stripes and lettering are all cut from sheet vinyl.

CONCLUSION

I think anyone who builds the little Camel will like it. It's a bit tricky to fly because of its size, but it sure looks good in the air. The ability to pick it up fully assembled and easily stow it in your car is a plus. Small biplanes are a blast!

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SOPWITH CAMEL: TREACHEROUS ALLY

When the Sopwith Camel went into combat in 1917—barely 14 years after the Wright boys had proved that flight was possible—it represented cutting-edge technology. Unfortunately, its 160hp Gnome rotary engine could make the airplane as dangerous to its pilots as its twin machine guns were to its adversaries.

The Camel's personality was forged not by its aerodynamics but by its engine—a massive gyroscope bolted onto the front of a featherweight airplane. To make matters much worse, it had no throttle. An on/off switch on the spade-shaped stick was used to momentarily kill the engine when power reductions were needed. Of course, the airplane rocked every time the pilot let go of the button.

This awkward power-control situation resulted in an airplane that was anything but easy to fly. It turned left in a more or less conventional manner, but right turns—though quick and wonderful combat maneuvers—were potentially lethal to the pilot. When it turned right, the airplane wanted to snap over the top,

and the pilot held almost full left rudder all the way through the seemingly simplemaneuver.

In the proper hands, the airplane was a deadly, nimble foe. It could out-climb most of its contemporaries, and its 120mph speed made it one of the fastest airplanes of the era. In careless or inexperienced hands, however, the Camel was all too likely to help the Germans win the War by accidentally killing fledgling Allied airmen.

—Budd Davisson

Gentlemen, start your engines

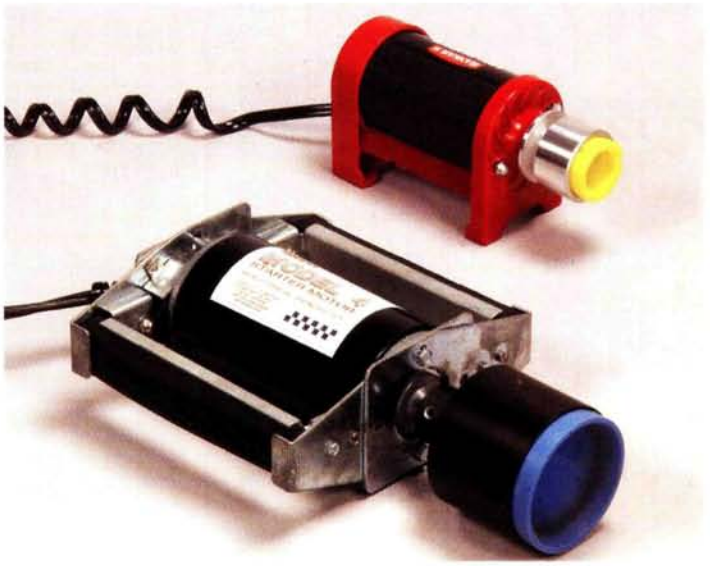
Stephen Johnson wheels his 40-percent Carden Aircraft Edge 540 from the pits for another exciting flight. The 118-inch aerobat is powered by a Desert Aircraft DA 150cc engine and weights 35 pounds. When you build them this big, your support equipment has to be up to the task!

To properly operate and maintain models, you need support equipment that is up to the task. Two of the most important concerns we have with giant-scale models are safely starting the engine and handling the fuel (gasoline). When we switch from glow engines to gasoline burners, we need to change some of our equipment; we need to start thinking big!

MIGHTY MEGATRON

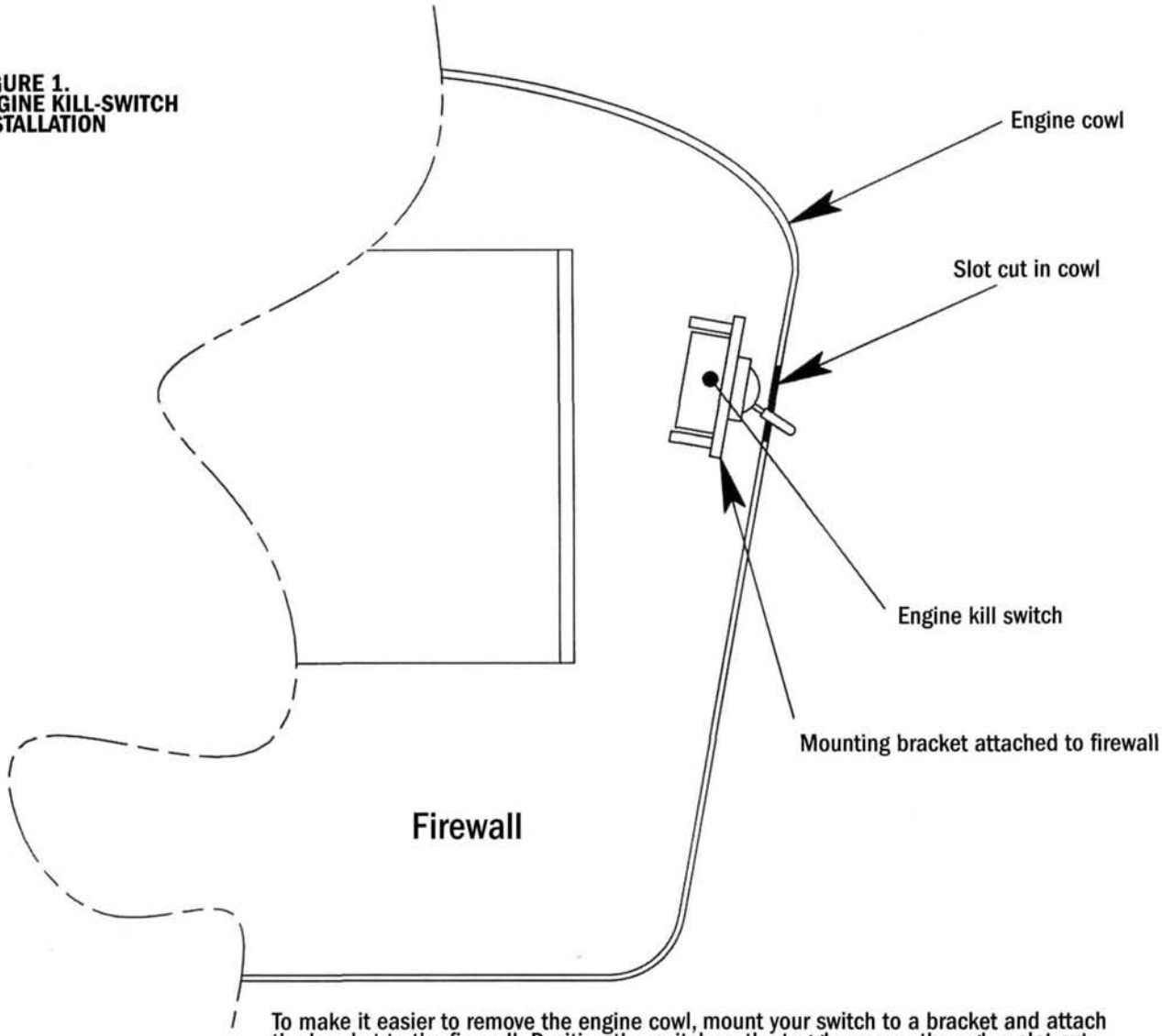
Hand-starting gas engines is a common practice, but it is much safer to use an electric starter. The old 12V starters that easily crank a standard glow-powered 2-stroke just won't work when you attempt to start a big gas burner. One solution is the double-handled, 12/24V Megatron starter from Sullivan Products. The Megatron uses the same powerful Model 4 motor that powers Sullivan's popular model-boat starter, and it is equipped with dual handles; it is specifically intended for starting large RC airplane engines. The Megatron can start most gasoline engines with up to 8ci in displacements. The power switch is incorporated in one of the rubber-padded handles, and the steel end plates prevent the motor from slipping under load. The Megatron comes equipped with a huge 3-inch aluminum cone and a sure-grip silicone rubber insert. The starter can operate on 12 or 24 volts and at a maximum of 100 amps. At 12 volts, its torque is 600 oz.-in.; at 24 volts, it's a whopping 1,200 oz.-in. It has a no-load rpm of 2,800 at 12 volts and 5,600rpm at 24 volts.

Two silicone rubber adapters are also available for the Megatron. The small adapter (item no. S636) is for 2¾- to 4½-inch-diameter spinners, and the large one (no. S637) fits spinners from 3½ to 6 inches in diameter. Give them a try!



Big gas engines require big electric starters. The Sullivan Megatron starter (shown with a standard-size starter) uses 12 or 24 volts and can turn over engines with up to 8ci in displacement.

FIGURE 1.
ENGINE KILL-SWITCH INSTALLATION



To make it easier to remove the engine cowl, mount your switch to a bracket and attach the bracket to the firewall. Position the switch so the toggle passes through a slot cut into the cowl.

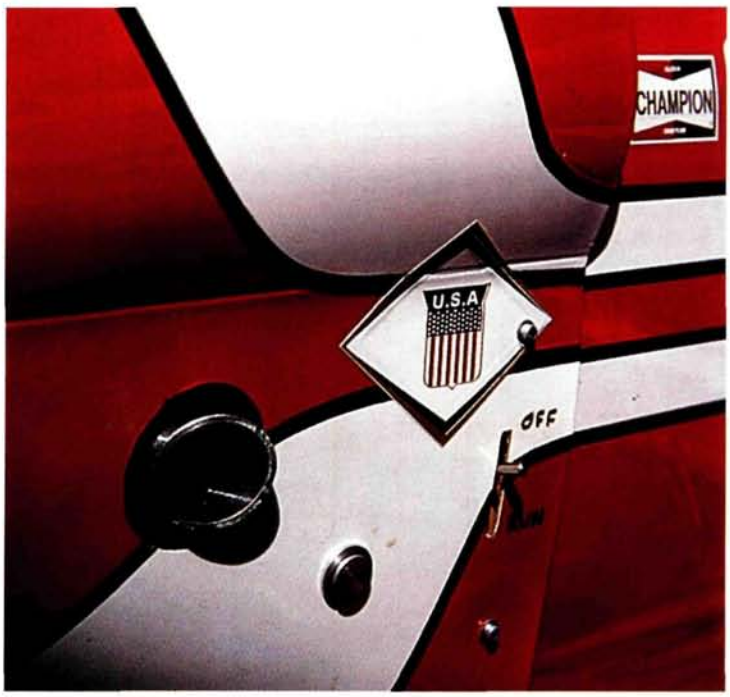
ONBOARD STARTING

Another way to increase the safety factor is to install an onboard starter. The simplest is a spring starter that is attached to the aft end of the engine's crankshaft. It consists of a heavy-gauge spring, attachment bolts and a coupler containing a one-way roller bearing. After you have installed it, start your engine by simply rotating your prop about ⅓ of the way backward (clockwise) and then release it. The spring flips the prop counterclockwise in the same way as a Cox ½A engine is started. Though very simple, these spring-starter systems work very well and almost never wear out.

When it comes to all the "firewall forward" parts, it's important to use the correct equipment for the job and to always be careful—especially with gasoline-powered engines.

SWITCH ON!

An easy-to-install, but often-neglected, safety device is the engine kill switch. A safety requirement at any IMAA-sanctioned event, an engine kill switch grounds the ignition system (magneto) to



An engine kill switch is an important safety requirement for any IMAA flying event. Here, you see the toggle switch sticking out of a slot I cut into my Pitts Special's engine cowl. The switch isn't anchored to the cowl itself; it is attached to the firewall with a plywood bracket.

Onboard spring starters, such as this one from Great Planes, are a great way to ease engine-starting chores. They are attached to the aft end of the engine's crankshaft and have a one-way roller bearing within the coupler.

the engine case and makes it impossible to accidentally start the engine. With electronic-ignition-equipped engines, the same thing can be achieved by adding a switch to the system's battery lead. Several pre-made switch harnesses are available, but you can easily make your own out of parts from an electronics store. All you need are two lengths of wire and an on/off toggle switch. One wire goes to the engine case (it's usually attached under a bolt head with a wire lug), and the other one is connected to the magneto. Most magnetos have either a wire lead or a solder tab to which you connect the grounding wire. Keep the wires as short as possible.

To make removal of the engine cowl easier, attach the switch to the firewall with a plywood or aluminum bracket, and let the switch toggle pass through a slot that has been cut into the cowl. Get into the habit of using the switch to shut off the engine, and make sure that it remains in the off position when the model is not in use.

The new Nifty Gasoline Pump from Sonic-Tronics doesn't have any moving parts and is completely sealed. There's no danger of sparks, and this makes it ideal for use with giant-scale models.

PUMPING GAS

A typical gasoline fuel tank used in giant-scale models holds anywhere from 16 to 32 ounces of gasoline. It takes a long time to hand-pump this much fuel into our models, and a standard electric fuel pump is not an option. Gasoline is much more volatile than glow fuel, and electric pumps can cause sparks—not a good thing around gas fumes. What's the answer? How about a fuel pump specially designed for gasoline that contains no electric motor, diaphragm, bearings, or any other part that could create a spark? That's just what Sonic-Tronics has developed with its new Nifty Gasoline Pump.

This totally sealed, solid-state unit is self priming and operates in only one direction, which is clearly labeled on its case. To empty your fuel tank, you must reverse the fuel lines. Reversing the battery leads with a switch will not operate the pumping mechanism; it won't hurt the unit, but it won't work. The pump produces a constant 6psi of flow pressure, and Sonic-Tronics recommends that you use a larger (⅛ to 5⁄32-inch i.d.) fuel lines and fittings in your model. The Nifty Gasoline Pump operates on 12 volts and requires about 1 amp of power. The unit comes completely tested and ready to use, but you have to supply your own power connectors. To identify the wiring polarity of the pump, the negative lead is marked with a black band. Used with gasoline-compatible fuel lines and an approved gasoline-storage container, the Nifty Gasoline Pump makes your pit area safer!

TAP AND DRILL GUIDE

By the time you get really involved in giant-scale modeling, your supply of workbench tools will have grown to address more advanced aircraft-building tasks. Drilling and tapping metal brackets and fittings are a big part of giant-scale modeling, and having a good set of drills and taps is a necessity if you plan to do all the work in-house. Here's a list of basic tap sizes and their corresponding drill sizes.

Tap size	Drill size
2-56	No. 51
4-40	No. 43
5-40	No. 39
6-32	No. 36
8-32	No. 29
10-24	No. 25
10-32	No. 21
¼-20	No. 7

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AT *MODEL AIRPLANE NEWS*, we not only tell you what's new, but we also try it out first so we can bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."

Mini Hobby ALT

APU II

All-in-one ground support

Let's face it: RC modelers need a lot of support equipment at the flying field. You can quickly fill a standard field box with essentials such as a power panel, a glow driver, a fuel pump and a starter battery. If you fly scale models that are equipped with pneumatic retracts, add an air compressor to the mix. Wouldn't it be nice if someone could combine all this equipment into a single, compact, easy-to-carry unit? Well, that's exactly what the talented folks at Mini Hobby have done, and they call it the Auxiliary Power Unit (APU II).

The APU II is a completely self-contained package that isn't much larger than one of those emergency lanterns you might keep in your car's trunk. The outer case is high-strength, fuelproof molded plastic, and the complete package—including its maintenance-free battery and air compressor—weighs only 10.25 pounds.

On the front of the unit, you'll find the main power switch, the air-compressor power switch, a 115V charging jack, a 15A fuse, three battery-condition LEDs and a large, 12V receptacle. Below these is the fuel-management compartment that houses the pump that has already been plumbed with Tygon fuel line. On the right side of the case are the 2V glow-driver output jacks and switch, a center-off, reversible fuel-pump switch and the 12V output jacks for your electric starter. The rear compartment contains the air hose, the glow-driver lead and the igniter clip. The air-pressure gauge and molded-in carrying handle are on top. For ducted-fan pilots, the left side of the case has two storage clips to hold a jet-starting wand.

The APU II also includes a 115V AC recharging adapter, a 12V DC charging adapter that plugs into your car's cigarette lighter, a pair of banana clips for your starter, a spare fuse, two air-pump adapter tips and several pages of instructions. For $249.99, the APU II is an excellent ground-support unit for any type of flying you might want to do. From sport flying to giant-scale and ducted-fan sorties, this unit satisfies all your needs. Give it a try; you'll love it. *—Gerry Yarrish*

Mini Hobby ATL (954) 746-3094; minihobby.com.

Great Planes

RealFlight Add-Ons, Volume 4

Add more excitement to your G2 flight sim

One of the things we really like about the Great Planes *RealFlight* simulator is that you can upgrade the program with "Add-Ons" that allow you to experience new flying fields, airplanes and helicopters. The newest edition, "*Add-Ons, Volume 4*," expands your virtual hangar with 14 exciting aircraft, three popular helicopters and four very cool flying sites. There's sure to be something for everyone.

The most exciting model in this *Add-On* is, without a doubt, the Harrier Jump Jet. Just as with the real jet, you can rotate the nozzles to take off vertically, and once you're airborne, you can rotate them again for conventional flight. To take full advantage of this feature, you need the new G2 USB Interlink Controller. Not to worry, though; if you have the older controller, you can use one of the switches to rotate the nozzles between horizontal and vertical flight. Flying the Harrier is a blast; as you take off vertically and increase the thrust, dust starts to blow up all around. Very cool! It takes some practice to fly the Harrier, but you'll be a better pilot after you've mastered it.

The four new flying sites are also very cool. If you like flying over open ocean, then flying from the battleship will provide many thrills. It's quite a kick to be launched from the catapult. If you're a chopper pilot, each site holds fun challenges for you. For example, Snow Park has open-ended hangars right next to the runway. I had a ball flying through them inverted and backward with the Caliber 30 heli.

This newest release from Great Planes has a lot to offer and is a lot of fun. The Harrier alone is worth the price of admission. *RealFlight Add-Ons, Volume 4* costs $29.99 and is a great addition to *RealFlight G2*. *—Rick Bell*

Great Planes Model Mfg. Co. (800) 682-8948; greatplanes.com.

Du-Bro Products Inc.

Snowbird Skis

Let it snow, let it snow, let it snow!

With Du-Bro's new Snowbird Skis, you no longer have an excuse not to enjoy winter flying. The skis are available as a set of two for tail-draggers, and a single nose ski is available to complete a tricycle-gear configuration. They're ideal for up to .60-powered models; they measure 2½x9½ inches and weigh just over 2 ounces each with the hardware attached to them. Molded of a high-density polyethylene in a choice of black or vibrant neon pink, the skis have runners molded on the bottoms for excellent handling on snow. A spring system ensures that they keep a slight positive angle during flight.

The skis come with all the hardware necessary to install them on your model, and installation is a simple task that takes only a few minutes. They can be used on both wire and aluminum-style landing gear, but you do need a 5/32-inch-diameter axle. First, remove the wheels from your model. Next, secure the mounting blocks to the skis. You screw them to the skis from the bottom with 4-40 screws and split washers. The blocks have threaded brass inserts for the screws; it's a good idea to use a little thread-lock compound to prevent the screws from backing out. Next, you place a wheel collar on the axle, followed by the ski. Then you slide a spring onto the axle; the front leg of the spring catches on a bolt that's inserted into another wheel collar, and this secures the ski assembly on the axle. The spring provides the tension that holds the tip of the ski in a positive position, and a rear leg on the spring prevents the ski from pointing vertically and creating excess drag. It's a clever and simple design.

To put the skis to the test, I installed them on a .40-size trainer that would be perfect for a little winter wonderland fun. The first thing I noticed when I placed the model on the snow was that the broad footprint of the skis provided a lot of support and prevented the plane from sinking in. Some taxiing maneuvers showed that the runners on the bottoms of the skis did indeed supply positive tracking.

Flying with skis proved to be only a little different from flying with wheels. I did need to add a little down-elevator trim to prevent the plane from climbing because the airflow hitting the bottom of the skis added some lift. Next winter, don't be grounded by snow; install a set of Snowbird Skis, and have a blast! The main skis cost $22.95; the nose ski costs $11.95. *—Rick Bell*

Du-Bro Products Inc. (800) 848-9411; dubro.com.

Specialty Press

"Luftwaffe Colours 1935–1945"

Color and markings documentation

Though much has been written about Luftwaffe aircraft, obtaining accurate marking and color-scheme documentation remains one of the biggest challenges faced by serious scale modelers. For them and others interested in aviation history, the pursuit of new sources of color information is never-ending.

Written by Michael Ullmann, the hardbound "Luftwaffe Colours 1935–1945" (ISBN1-902-109-34-1) is an impressive study of the development and use of the many unique colors used to paint the German warbirds of WW II. Between the covers of this new 256-page Specialty Press book, you will find 300 black-and-white photos, 16 pages of color drawings and several detailed illustrations that show almost everything there is to know about accurate color and markings. A color chart in the back of the book shows 44 accurate Reichsluftfahrt Ministerium (RLM), or State Ministry for Aviation, paint chips.

Referencing much original Luftwaffe documentation, the author discusses how and why these aircraft finishes were developed and applied to military (as well as to Lufthansa) aircraft. Official camouflage patterns for almost every type and variant of German aircraft used during the period are shown in great detail. Information on paint manufacturing and classification by the Reichsausschuss für Lieferbedingungen (RAL), or the Reich Committee of Conditions of Supply, is included, and a historical breakdown of the German aviation paint industry adds depth to the subject.

From zeppelins and early cargo and airliner aircraft to gliders, trainers, seaplanes, bombers and even the Luftwaffe jet-powered fighters, all the paints, shades and camouflage schemes are defined. Scale, color, 3-view drawings show typical camouflage patterns, and several photos of cockpit interiors with appropriate RLM color references are also included.

If you want to know all there is to know about painting WW II-era Luftwaffe aircraft, this book is definitely for you. Priced at $49.95 (plus $4.95 S&H), it is a useful addition to anyone's aviation-documentation library.—*Gerry Yarrish*

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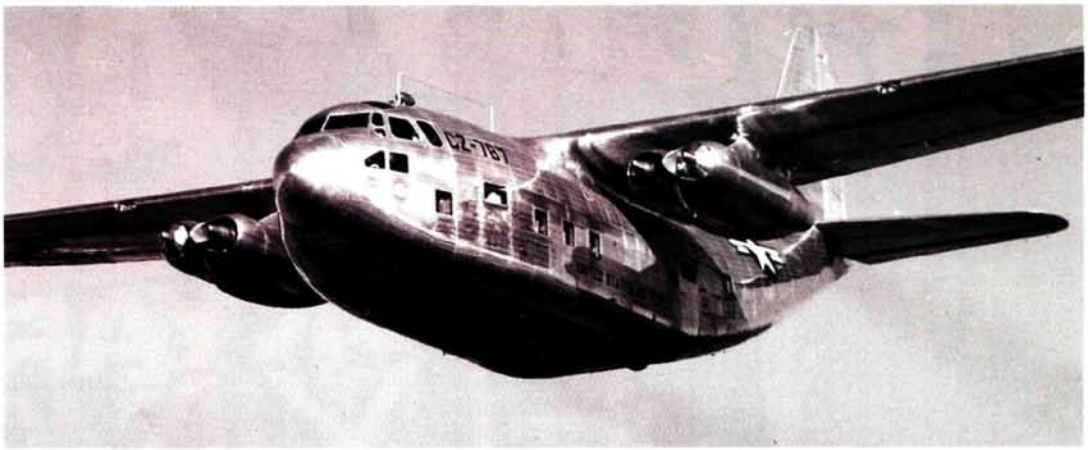

Congratulations to Jesse Sheperd of Bedford, TX, for correctly identifying February's mystery plane as the North American AJ Savage—a large, carrier-borne attack bomber. First flown in May 1949, the Savage flew with a crew of three and was capable of carrying an atomic bomb. It featured tricycle landing gear, a high wing and Hamilton Standard-designed, 4-blade propellers to provide high takeoff thrust and excellent performance at high speeds and altitudes. It had a maximum level speed of 471mph. Two 2,400hp Pratt & Whitney piston engines and an Allison J33 turbojet in the rear fuselage powered the prototype (shown here). Ultimately, three versions of the Savage were produced (AJ-1, AJ-2 and AJ-2P), totaling 140 aircraft. It remained operational until 1959, and at that time, some were converted into refueling tankers.

The winner will be chosen, four weeks following publication, from correct answers received (delivered by U.S. mail) and will be awarded a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will be given a free, one-year subscription extension.

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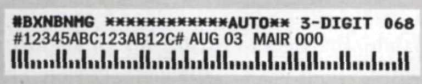

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BY JAIME LAGOR

Out-of-this-world flyer

We're all aware of the impact that advances in technology have on the RC industry, and the rate at which it is propelling us forward is somewhat staggering. But advances in aerodynamic design are just as rapidly redefining the world of aviation at large, the products of which may very well extend beyond our wildest imaginations and have tremendous implications for the future of our hobby.

The Geobat is a polished-aluminum flying disc that's both extremely stable and highly aerobatic. Once thought to be only the subject of science-fiction folklore, such an aircraft may one day be a reality in full-scale aviation. Designed by Jack M. Jones, the Geobat seems to be the first almost circular design in the history of aviation with flying characteristics that are stable, predictable and responsive enough to make it a viable and marketable aircraft capable of competing with existing planes.

Historically, flying-disc configurations have been inherently unstable and inefficient with regard to lift, but Jack incorporated several design features that truly set the Geobat apart. Even engineers at the Naval Research Laboratory have taken note of the Geobat's unusually stable flight characteristics. First, the wing comprises three separate sections, and wingtips connect the forward and rear wing. Second, the forward half of the disc has a larger area than the rear; this mimics the design of standard airplanes, in which the larger wing is forward of the smaller stabilizer. Third, the inboard and outboard ailerons work in unison to ensure extremely responsive lateral control.

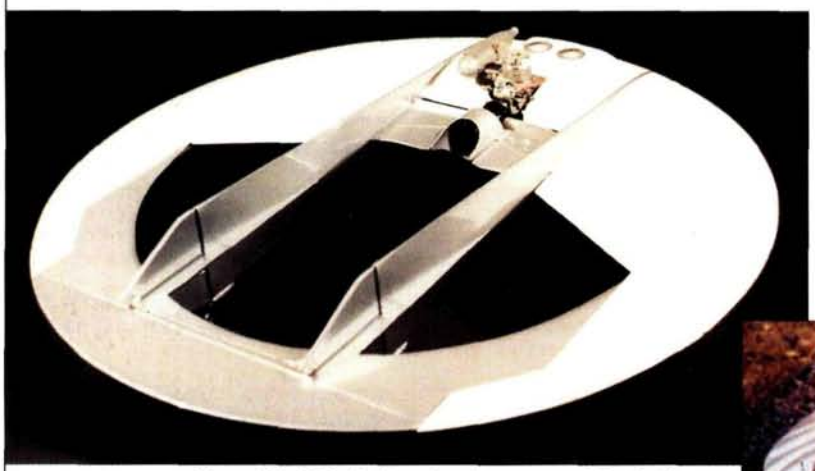
The response to Jack's design has been so positive that the production of a full-scale Geobat may one day be a reality, but to date, the Geobat exists only in RC form, and a plan for it is available. Powered by a .40 to .46 engine, the Geobat has a 40-inch diameter and requires a 4-channel radio with five servos. With the exception of the engine and landing gear, the top and bottom of the aircraft are identical. All cambers are symmetrical and, with the exception of a taper in the wings as they extend laterally, it has no dihedral.

According to Jack, the Geobat is highly aerobatic but surprisingly easy to fly. It's capable of high angles of descent while maintaining horizontal control, and the application of full up-elevator with the power off makes it look as if it's hovering (a good way to scare the heck out of the neighbors!).

The Geobat's design process is by no means finished. This unique platform lends itself to experimentation. A 36-inch-diameter, electric-powered experimental version allowed Jack to test the possibility of adding a payload/cockpit area without sacrificing stability. It was after he had determined that this was possible that he began to dream of building a full-size Geobat.

Jack says that even more radical versions are in the works, and he welcomes any thoughts his fellow modelers may have on the subject. If you have any design ideas that you'd like to contribute, or if you would like more information, go to geobat.com.

Editor's note: C60WORLD now has exclusive rights to the "Three Wing Circular Planform Technology."



Above: this 40-inch-diameter, glow-powered Geobat is one of a kind. Though now only available in RC, its original design features could one day revolutionize modern aviation. Right: this electric-powered experimental version of the Geobat allowed Jack to determine that a full-size version is a possibility. The addition of the payload/cockpit area doesn't affect the model's stability.